TMAP®:

High-performance quality engineering

Sample exam

Version	1.01
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Introduction

This is the sample exam for the certification "TMAP: High-performance quality engineering" which is part of the TMAP certification scheme. The requirements for this exam are described in the syllabus.

The format of the exam is multiple choice. There are 40 questions, 20 relate to K2 LOs, 20 relate to K3 LOs (K1 LOs are not explicitly examined). Each correctly answered K2 question gives 1 point, a correctly answered K3 question gives 2 points, in total 60 points can be achieved. To pass the exam, at least 66% of the points (that is 40 points) must be achieved.

The available time for the exam is 1,5 hours (90 minutes). This time is also sufficient for non-native English speakers to complete the exam. Currently the exam is only available in English, translations to other languages may follow in the future.

The exams and certificates are provided by the independent exam provider iSQI. The syllabus and other information can be found at: www.isqi.org.

For more information about the TMAP body of knowledge see www.tmap.net.

To contact the Sogeti academy in the Netherlands please contact academy.nl@sogeti.nl.

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Revision history

Version	Date	Author	Remarks
0.1	19-05-2021	Questions & Exercises team	New document
0.9	21-05-2021	Guido Nelissen	Version for try-out group
1.0	26-05-2021	Rik Marselis	Final version
1.01	09-08-2021	Rik Marselis	Exam duration in introduction was wrong and page alignment improved.

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1. Questions

1.1. LO01 - The VOICE model of business delivery and IT delivery

According to the VOICE model, why is “Value” a vital starting point for IT delivery?

A. By taking Value as a starting point, the team can interpret the indicators and reports using a confidence monitor.
B. By taking Value as a starting point, the users experience the real value based on the outputs and results of the system.
C. Taking Value as a starting point defines several different but coherent aspects that together will make the confidence in the business value measurable.
D. Taking Value as a starting point ensures that the focus is on the goal of IT delivery, and the people involved keep being reminded that IT delivery itself is not the goal.

1.2. LO05 - Cross-functional teams

How does a cross-functional team in high-performance IT delivery work more effectively than a multi-disciplinary team?

A. A cross-functional team consists of specialists that are very good at one task and work in silos which is the most efficient way of working.
B. A cross-functional team stives to automate as many tasks as possible and therefore are more efficient than multi-disciplinary teams.
C. Because the people in the cross-functional team are prepared to pick up any task, the team is able to still function when one of the team members is temporarily unavailable.
D. The people in the cross-functional team select a role based on their skills and the tasks on the backlog and they keep the same role during the entire sprint. Therefore they will be more effective than a multi-disciplinary team where team-members always have the same function.

1.3. LO06 - CI/CD pipeline

Which of the following quality engineering activities is performed during the Team test stage of a CI/CD pipeline?

A. Deploying the software package to the test environment.
B. Merging all features from various branches.
C. Monitoring the behavior of the testing system.
D. Running automated unit tests.

1.4. LO07 - Capabilities

The IT manager of QualityLand wants to support automation of most tasks that the DevOps teams need to perform. Therefore she has decided to implement a new CI/CD pipeline. She asks you to tell her which tools are now in use and what tools are needed extra to those existing tools so that the pipeline can be constructed.
What is your action and/or advice?

A. You make an inventory of all existing tools. You search for examples of CI/CD pipelines of other companies (that are similar to QualityLand) and based on that you make a complete list of the tools needed.
B. You tell the IT manager that implementing DevOps does not mean that a CI/CD pipeline is needed and that also automation of tasks is not very important since the team members are very good at their job and there have not been complaints so far about the use of the tools that are currently in use.
C. You ask the IT manager, the team members and other people involved in IT delivery about the capabilities that are needed in the pipeline. Based on these capabilities you determine which existing tools would fit in and what new tools need to be implemented.
D. You investigate the capabilities of the team members to see with which of the existing tools they can easily work. Then you contact an external consultant to make an independent selection of tools for the CI/CD pipeline.

1.5. LO08 - Introduction QA & testing topics

What is the correct description for the Performing topic "Quality measures"?

A. Stakeholders will want to know if the QA and testing tasks are performed in an effective and efficient manner. Therefore they must be defined.
B. Based on the acceptance criteria, decisions are made on the relevant quality measures.
C. For specific user needs it must be clear when they are fulfilled.
D. The quality measures describe how the investment in QA & testing activities is balanced over the test object.

1.6. LO09 - Monitoring & control

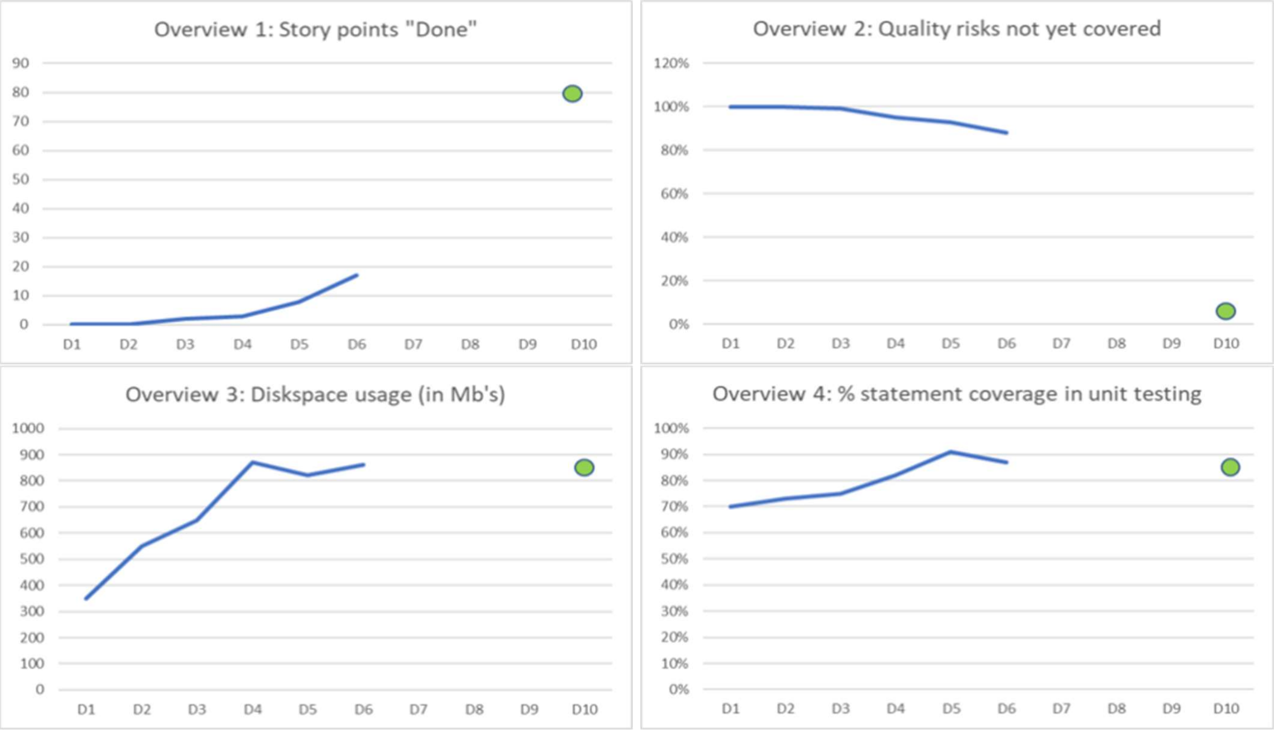
The PO (Product Owner) of the QualityLand DevOps team wants to monitor the progress of the delivery of new software features by the team. She is unsure which of the following indicators she should use:
- Market share increase
- Functional components done compared to defined
- Quality of the refinement process

Which option would you advise her?

A. Market share increase
B. Functional components done compared to defined.
C. Quality for the refinement process
D. All options, because this will give even more insight in the progress of delivery of features.

1.7. LO10 - Reporting and alerting

Your cross-functional team is working in a sprint that has 80 story-points of tasks on the backlog. Four indicators are used to track progress and give insight to everybody involved. The indicators are visualized in four overview-reports that are shown with this question. Your team is at the start of day 7 of the 10-day sprint and in the standup-meeting you must briefly comment on the forecast of whether your team is likely to meet the targets (targets are indicated with green dots).
What is your summary about the status?


Overview 1: Story points "Done"

Overview 2: Quality risks not yet covered

Overview 3: Diskspace usage (in Mb's)

Overview 4: % statement coverage in unit testing

A. We have had a very slow start this sprint because of problems in our pipeline tooling. Therefore we could not merge any code in the main branch and it is unlikely we will make up for that, looking at story points done and quality risks covered.
The use of diskspace must be balanced and we have quickly found this balance and expect to maintain the targeted level.
Our goal of 85% statement coverage with our unit test cases was reached and we are confident we can maintain this.

B. Although we had a slow start this sprint it is normal that at 60% of the sprint only 20% of the work is done, we can easily make up for this in the remaining 4 days of the sprint.
We are worried about the diskspace usage because the target of 850 Mb is very close to 1 Gb.
The target for statement coverage can most likely not be met, therefore we propose to turn to line coverage which would give us more confidence.

C. All graphs show that we are in deep trouble. The story points "done" are our only light in the tunnel because we think we can still manage to finish the remaining software. However we won't be able to test all software before the end of the sprint so the risks not covered will remain high and the statement coverage will keep dropping like the trend already shows.
   The diskspace usages is the least of our worries.
D. The graphs of Story points "done" (burn-up) and "Quality risks not covered" (burn-down) clearly show that the product owner has forced our team to put way too many user stories on the backlog because we will never be able to meet the target.
   We have already ordered extra hard-disks because the graph of the diskspace usage shows that with this limited amount of software the usage already goes "through the roof".
   The only positive graph is statement coverage so therefore we propose to improve the unit testing coverage to line coverage.

1.8. LO11 - Infrastructure

The QualityLand DevOps team is about to implement a new IT system, this includes implementation and configuration of the infrastructure. The team uses cloud infrastructure that is defined as Infrastructure as Code (IaC) using Terraform.
The Scrum master is new to the team and has no experience with IaC. He ask you how you will verify that the IaC indeed complies with the requirements and needs of QualityLand.
What do you explain to the Scrum master?

A. You explain to the Scrum master that in QualityLand a virtual team will be created with a end-to-end quality orchestrator and members from all teams involved that will organize and perform an end-to-end regression test for the IT system and the business process that it supports.
B. You explain to the Scrum master that Terraform is a Domain Specific Language (DSL) that is used to specify what infrastructure needs to be supplied to support the business process. Using IaC enables easy extension of infrastructure when the needs for infrastructure increase.
   All people that create Terraform code within QualityLand follow the common guidelines and practices that are also used for other pieces of code, such as modularization, versioning, repeatability, security compliance and code reviews.
C. You explain that parts of the infrastructure verification will take place in all fundamental DevOps activities. For example in the Plan activity you validate the architectural design, in the Code activity you verify the syntactical correctness, in the Integrate activity you assess aspects like security certificates and database configuration, in the Deploy activity you focus on stability, performance etcetera and in the Operate and Monitor activities monitoring is used to collect feedback from live operation.
D. You explain that infrastructure verification is a key activity of the team member with the business analysis role. This person will check if the IaC that has been specified is sufficient to support the business process.
   Also you explain that with IaC there is no need for checking technical details (such as correct ports, firewall rules, security certificates, assigned diskspace, OS version, etc.) because Terraform will automatically deploy this.

1.9. LO12 - Metrics

The QualityLand DevOps team wants to improve their IT delivery process in the CI/CD pipeline in order to improve their velocity (and thus lower the costs per story point).
To measure the improvement two metrics need to be defined.
Which of the following metrics can be used to measure the improvement?

A. 1) Fault density
   2) Anomaly detection effectiveness
B. 1) Savings achieved by reusing test products
   2) Percentage of test costs
C. 1) Percentage of automated tests related to risk coverage
   2) Percentage of appropriate use of testing techniques
D. 1) Savings of the test
   2) Percentage of code coverage

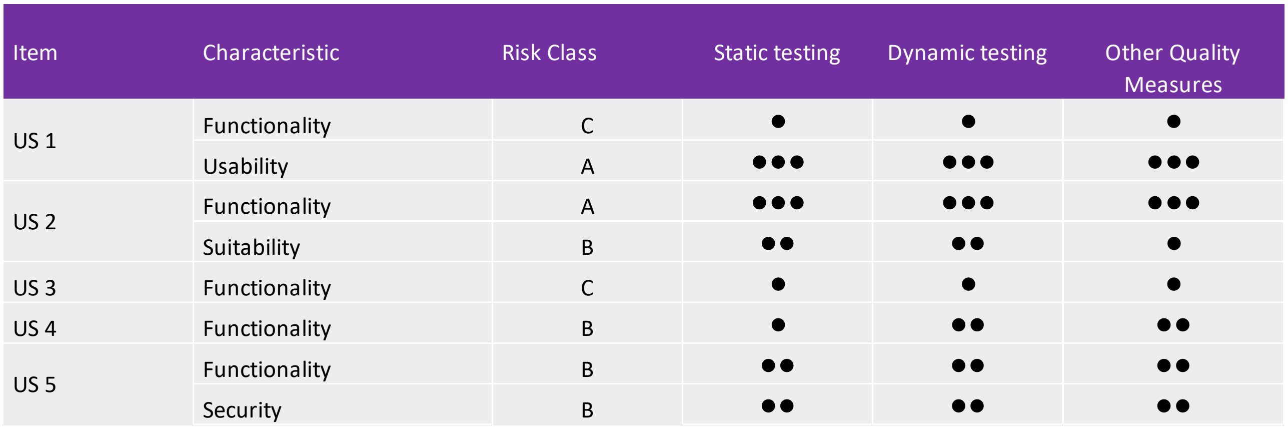
1.10. LO13 - Continuous improvement

Henrik, the Scrum master, is very happy with the current maturity of your DevOps team. But he already warns you that in this everchanging world a status quo actually means going backward. To make sure the team stays up to date he wants you to implement continuous improvement and asks you to propose an approach for this.
What is your proposal?

A. You propose to apply the Deming cycle. This means that first you analyse the current situation and develop ways to improve, then you test one or more alternatives, you determine whether the trial is working as intended (if not, revisions are needed or the alternative is scrapped) and if the improvement works satisfactory then it is implemented.
B. You propose to apply the Quality to Activity Mapping approach. This gives substance to six pre-defined Quality Key Areas (QA awareness, QA & Testing, Governance, Transparency, Automation and Infrastructure).
   This table supports the improvement of the QA & Testing skills of the people in the team.
C. You explain to Henrik that you will implement the fundamental activities (Plan, Code, Integrate, Deploy, Operate and Monitor) that will help to solve inefficiencies within the systems manufacturing process.
D. You explain to Henrik that to implement an improvement culture there needs to be focus on Product (quality of the application), Process (DevOps QA&Testing activities) and People (QA & Testing skills). To cover all these aspects you propose to implement descriptive analytics.

1.11. LO14 - Quality risk analysis & test strategy

Select a possible quality measure, test approach or test design technique to dynamically test the functionality for US3.



Item	Characteristic	Risk Class	Static testing	Dynamic testing	Other Quality Measures
US 1	Functionality	C	●	●	●
	Usability	A	●●●	●●●	●●●
US 2	Functionality	A	●●●	●●●	●●●
	Suitability	B	●●	●●	●
US 3	Functionality	C	●	●	●
US 4	Functionality	B	●	●●	●●
US 5	Functionality	B	●●	●●	●●
	Security	B	●●	●●	●●

A. Data Combination Test (with coverage of all combinations of all classes)

B. Technical review

C. Exploratory testing

D. Pair programming

1.12. LO15 - Acceptance criteria

Your fellow team member Kamlesh has written acceptance criteria in Gherkin style before coding has started. You pick up the task from the scrum board (in the role of tester) to review, verify and accept these criteria. Of course you use the seven tips of Ravlani.
What is your conclusion about these two acceptance criteria?

Given the QualityLand visitor wants to know the waiting time for a roller coaster
When she wants to select which roller coaster
Then a list must be presented with the fairyland roller coaster and the high-rock roller coaster.

Given the QualityLand visitor wants to know the waiting time for the fairyland roller coaster
When she uses the mobile app
Then the response must be fast enough for the average user.

A. Your conclusion is that both acceptance criteria comply with all tips. However you would advise to delete the second acceptance criterion because usually mobile apps will be fast enough anyway and testing this would cost a lot of effort for the team which can be better spent on other activities.
B. Your conclusion is that the first acceptance criterion complies with all tips of Ravlani (for as far as you can see within the scope of this case) and the second acceptance criterion does not comply with the tip of having a clear pass/fail result. Also you as a team member shouldn't be the only one to verify the acceptance criterion, the Product Owner must verify.
C. Your conclusion is that both acceptance criteria do not comply with all 7 tips because they are not independently testable (tip 3) and because the acceptance criteria cannot be written after finishing the program code and implementing the user story.
D. Your conclusion is that the first acceptance criterion is OK.
The second acceptance criterion is as good as it gets because if you would elaborate further then tip 5 (focus on what, not on how) would be violated, especially when exact performance criteria would be given.

1.13. LO16 - Reviewing

A new Product Owner has recently joined your DevOps team. He has a lot of experience in amusement parks but doesn't have any experience with DevOps. While you are working together on the user stories you mention to the Product Owner that you will apply the four amigo's approach.

One of the new user stories is described as:
The new Virtual Reality (VR) attraction uses simple cardboard goggles in which the QualityLand visitors insert their own smartphone and then get the VR experience. This attraction shows a stereo-video and must be compatible with all major smartphone operating systems.
The Product Owner listens in on the four amigo's session of your team and is surprised by the in-depth discussion between the team members. After the session he asks you to explain why this review technique involves discussion instead of just mentioning anomalies if these are observed.

What do you explain to the Product Owner?

A. You explain that whenever a deliverable is reviewed the four amigos study the deliverable and then exchange their views to get a common understanding of the user story which will result in a better final version of the user story.
   In this example (with a new VR attraction) the team members will discuss specifically the non-functionals of this new attraction because there is little experience with this new technology.
B. You explain that the n-amigo's approach means that all team members will behave in a friendly way and leave room to each other to express their own ideas and feelings. After that the Scrum master will decide what is the best approach to implement this new user story which by the way basically is a functional challenge because the show must meet the look-and-feel of QualityLand.
C. You agree with the Product Owner that there is too much talking in your team and therefore you propose to the product owner to join forces to convince the team members that it is far more efficient and effective for the team to implement Inspections as a formal review technique.
   In this specific example with the VR attraction the advantage of a formal inspection will be that all roles involved can do their own individual review and this way the highest number of anomalies can be detected. After all anomalies have been collected the author of the user story can improve the story.
D. You explain to the Product Owner that DevOps is a whole-team approach in which normally everybody in the team is involved in all discussions about user stories, but because the team is behind on schedule they have decided to scale down to the four amigo's approach so that only four team members are involved and other team members can pick up other tasks.

1.14. LO17 - Pull-requests

Children often want to buy some candy for themselves in QualityLand.
Their parents give them some pocket money, in this case 1 euro.
Every piece of candy costs 50 cents.
This piece of code (in Python language) calculates if the child has enough money to buy a piece of candy.

```
candy = 0.50

class Person:
def __init__(self):
 ""Sets the money available""
self.money = 1

def calc_pers_money(self, money):
    ""Calculate if the visitor has enough money available for candy""
    money_left = money - candy
    if money_left >= 0:
        print("You can buy candy")
    else:
        print("You don't have enough money")
```

You're assigned to review the code as part of the pull request. Use the following checklist:

1. method names may not be longer than 15 characters (a method is indicated by "def")
2. lines within a method must have indentation (one tab or 4 spaces at the start of each line)
3. method names should be snake_case (lower case and underscores _)
4. methods should contain docstrings (comments starting with "")

Does the code above meet the requirements of the checklist?

A. Yes, the code complies with all rules from this checklist, so the code can be pulled into the main branch.
B. No, the code does not meet all criteria from the checklist. Not all of the code uses indentation, so the code cannot be pulled into the main branch.
C. No, the code does not meet rule 2 (indentation) and rule 3 (snake_case), so the code cannot be pulled into the main branch.
D. No, the code does not meet rule 1 and rule 4 of the checklist so the code cannot be pulled into the main branch.

1.15. LO18 - Test data management

The QualityLand team wants to use data from the production system in the test environment. One of the team members has applied data scrambling and rule-based masking. Based on the data in the original table she has created four data sets.

Name	Date of birth	IMEI of phone	Total year-income
Fred Cooper	1988-07-15	86-123456-654321-9	€ 34.543,23
Ed Armstrong	1967-04-23	65-223344-556677-3	€ 102.543,99
Nancy Astaire	2001-07-01	34-142536-867564-2	€ 25.672,81
Pamela Jules	1999-09-14	85-839204-218594-3	€ 69.550,25

Which of these data sets has been correctly masked?

A.

Name	Date of birth	IMEI of phone	Total year-income
Elon Musk	1970-07-15	86-123456-654321-9	€ 55.555,55
Angela Merkel	1958-04-23	65-223344-556677-3	€ 55.555,55
Bill Gates	1960-07-01	34-142536-867564-2	€ 55.555,55
Oprah Winfrey	1965-09-14	85-839204-218594-3	€ 55.555,55

B.

Name	Date of birth	IMEI of phone	Total year-income
Fred Cooper - test	1988-01-01	88-9999-7777-1	€ 34.543,23
Ed Armstrong - test	1967-01-01	432-432-432-1	€ 102.543,99
Nancy Astaire - test	2001-01-01	335-334455-888-44	€ 25.672,81
Pamela Jules - test	1999-01-01	73.788.377.730	€ 69.550,25

C.

Name	Date of birth	IMEI of phone	Total year-income
Pinus Strobus	1988-07-01	76-234567-543210-9	€ 34.543,23
Salvia splendens	1967-04-01	54-113344-446677-3	€ 102.543,99
Viscum Album	2001-07-31	23-142511-867511-2	€ 25.672,81
Yucca Filamentosa	1999-09-01	77-382940-852194-3	€ 69.550,25

D.

Name	Date of birth	IMEI of phone	Total year-income
Ed Armstrong	1901-02-01	86-123456-654321-9	€ 322,44
Nancy Astaire	2019-03-02	65-223344-556677-3	€ 102,01
Pamela Jules	1909-05-31	34-142536-867564-2	€ 1.111.111,11
Fred Cooper	2020-04-30	85-839204-218594-3	€ 444.444,44

1.16. LO19 - Test automation

A new team member joins your team at QualityLand and the DevOps culture with its CI/CD pipeline is still new to him. He asks you to what extent you have implemented the "everything as code" automation principle.
You answer that you have implemented this principle as much as possible and you give an example to prove this. Which is the example you give?

A. You explain that additionally to automated testing you also create exploratory testing charters to make sure that the people involved have a personal chance to establish their confidence in the IT system.
B. You explain that even the documentation is implemented as documentation as code. Using a common markup language (in your team that is Doxygen) this enables aligning the versioning of the software and documentation.
C. You explain that to establish quality at speed automation is inevitable and therefore your team has implemented test orchestration to elimination "islands of automation".
D. You explain that as part of the continuous testing the team is moving towards auto-generation of test cases, to reduce workload on creating test cases. You use model based testing tooling for this.

1.17. LO20 - Test execution

In your DevOps team at QualityLand a new feature is in the team test stage. Another team member has prepared test cases based on the acceptance criterion "functional correctness" that is marked on the story card.
You notice that "usability" is also marked as an acceptance criterion on the story card but no test cases are created for this yet.
The Product Owner tells you that the feature will only be used by the QualityLand employees and they will all get training before they start using the feature, so this feature is low risk.
How will you execute the test for the new feature?

A. You create extra test cases to explicitly test for usability. Since it is low risk you only create five test cases to prevent too much testing effort.
When this test preparation is ready you execute both the test cases for functional correctness and for usability and register the results.
B. You create a test automation script so that the test cases that were created for functional correctness can be automatically run. The advantage of automating the test execution is that usability aspects will also be observed by the test automation tool. Based on the output of the test automation tool you register the results for further investigation and assessment.
C. You execute the test cases for functional correctness (that were previously prepared). Since usability is not important you ignore this acceptance criterion.
D. You execute the test cases for functional correctness (that were previously prepared) and during test execution you implicitly test the usability of the feature. For this you have retrieved the usability checklist that was created long ago for this purpose.

1.18. LO21 - Investigate & assess outcome

When booking a stay at the QualityLand hotel, guests can get 10% discount if they book 3 or more rooms in the same transaction.
In the role of developer Uzgur has created an app which contains this piece of code:

```
IF number-of-rooms > 3
THEN MOVE “10% discount” TO status
ELSE MOVE “no discount” TO status
ENDIF
```

In de role of tester, Subba made the following test cases:

TC1: number-of-rooms = 1, expected outcome “no discount”
TC2: number-of-rooms = 2, expected outcome “no discount”
TC3: number-of-rooms = 3, expected outcome “10% discount”
TC4: number-of-rooms = 4, expected outcome “10% discount”

The people in the team who have development skills currently are all very busy and won't have time to do immediate fixes if that would be needed.

You execute the tests. What is the outcome and what steps do you take?

A. Test case 3 fails.
You investigate the fail and conclude that the code doesn't comply with the requirement.
Since there is no team member available who can fix this fault immediately, you gather evidence, reproduce the fault, make sure that indeed the test cases are correct, create an anomaly report in which you register that the fault is in the code. You ask another team member to review the anomaly and after this it is put on the teams backlog.

B. All test cases are good and since you are responsible for having correct test cases your job is done.
You register that the quality risk is properly covered so the stakeholders can have confidence in the pursued business value.

C. Test case 3 fails because the code should have been "IF number-of-rooms >= 3".
Since all team members with development skills are busy you send a text-message to the mobile phone of one of the team members with development skills to ask her to fix this as soon as she has time.

D. Test case 3 fails.
You investigate the fail and conclude that the test case must be wrong since Uzgur is the most experienced developer in the team and Subba only just started in the team and doesn't have much experience.
Since there is no team member available who can fix this fault immediately, you change the test to:
TC3: number-of-rooms = 3, expected outcome “no discount”
You execute the test again and report the quality risk is covered.

1.19. LO22 - Quality measures

While discussing useful and practical quality measures to be used in the next sprint within your DevOps team, you state that it is of vital importance that the various quality measures are cohesive.
Greg, your fellow team member, asks you to explain why this is so important.
What is your answer?

A. In TMAP there is a specific list of 10 quality measures that, if all of those are applied, will guarantee that quality engineering is successfully implemented.
B. No single quality measure is an independent activity, it is only a small cog in the quality management wheel. And quality assurance is, in the end, only one dimension of quality engineering.
C. The quality measures must be cohesive which means that you choose between preventive, detective or corrective quality measures so that the selected quality measures aim for the same effect.
D. Based on the DevOps activity you are involved in (such as Plan, Code, Integrate, Deploy, Operate or Monitor) you select the QA & Testing topic that is specifically related to that activity. Then select the quality measures that belong to that Topic to ensure having cohesive quality measures.

1.20. LO23 - Specification and Example

The QualityLand fast-food restaurant has a mobile app for ordering food. To support a healthy lifestyle the app gets a new feature that counts the calories of the food items that the user selects. The app should give a warning if the calories exceed 900 for a woman and 1100 for a man.
Your team works in a timeboxed session to capture the information about this feature of the app and you have created an example map as shown.

Feature The food-ordering app gives a warning if the calories of the selected food-items exceed limits.			
Rule 1 For a woman the warning-limit of calories is 900. For a man the warning-limit of calories is 1100.	**Rule 2** A person that orders for multiple people must indicate how many women and men.		
Example 1 A woman that only orders one icecream-cone gets no warning.	**Example 3** A person that orders for multiple people will get a warning if the total calories exceed the total limit.	**Example A** If the order is for a child no warning will be given (because this differs too much to be reliable)	**Question X** How does the app know if the person is a woman or a man or a child?
Example 2 A woman that orders two complete hamburger-meals including extra sauce gets a warning-message.	**Example 4** A man that orders meals for himself and two women will get a warning message if the calories exceed 2900.		**Question Y** How does the app know the number of calories for each individual product?

You have thought of 1 additional example (A) and two questions, X and Y. What must be done with these examples and questions?

A. Example A is added to Rule 2.
   Question Y is not registered because the product owner has the opinion that this is a technical detail.
   Question X is not registered because it can be answered on the spot.

B. Example A is added to Rule 1.
   Question X and Y are deleted because the product owner answers them during the session and the people present will remember his answers.
   A new question is added what happens if a certain product is not available at the moment that the customer tries to order it.

C. Example A is added to Rule 1.
   Question X is registered so that the product owner together with the business analyst of the team can determine how to get the gender of the persons involved.
   Question Y is registered so that the product owner together with a database specialist can determine how to store the calories per product.

D. You suggest to add a different example containing people that are elderly (above 70 years) because they generally need less calories on a day. This must be added to rule 2.

1.21. LO24 - Test-driven development

In your team at QualityLand your fellow team member Heidi proposes to improve the way unit tests are created by implementing Test Driven Development (TDD). She has taken a training course and remembers that one of the advantages of TDD is that no more code will be written than is necessary. But she forgot how this TDD principle is called.
Which of the TDD principles has this advantage?

A. The TDD principle "Red, Green, Refactor".
B. The TDD principle "Keep It Simple Stupid" (KISS).
C. It's all about collaboration.
D. By combining TDD and Specification and Example approaches the team can generate an effective and balanced set of test scenarios.

1.22. LO25 - Feature toggles

Which of the following is the correct description of an Ops Toggle?

A. This toggle serves to disconnect the feature release and the deployment schedule. It also prevents the use of feature branches and additional merge difficulties.
B. This toggle is used to make specific parts of the application accessible to a specific set of users. These should not be confused with authorization rules, however.
C. This toggle controls turning experimental features on or off. A perfect application for this toggle is to perform a Canary release
or A / B testing .
D. This toggle can be seen as a circuit breaker for non-essential functionalities. Features with a large performance impact can, for example, be switched off dynamically when the application experiences a high load.

1.23. LO27 - Test varieties

Frederique is the Product Owner of your QualityLand team and she asks you what your team will use to determine the variety in testing that is needed.
What is your answer to this question?

A. We use quality characteristics to determine the test strategy with enough variety.
B. We use the spheres of testing (such as unit, system and business perspective) to determine the test varieties needed.
C. We use the testing pyramid and the testing quadrants to determine the relevant test varieties.
D. We use the quality characteristics, the spheres of testing, the testing pyramid, the testing quadrants and whenever relevant even other perspectives to determine the test varieties.

1.24. LO28 - Quality characteristic maintainability

Menno, a developer in the IT team of QualityLand, has the following plan to reduce technical debt: All software classes should be composed of discrete (separate and independent) components, so that a change has minimal impact on other components. Which aspect of maintainability is Menno talking about?

A. Analyzability
B. Modifiability
C. Modularity
D. Testability

1.25. LO29 - Mutation testing: Test the tests

The new butterfly-ride in QualityLand is only for young children. The selection is based on the age.
Children that are not older than five years get access, other children are not admitted.
Your fellow team member Sigrid has created the following test cases:
TC1: age is 4, child gets access
TC2: age is 5, child gets access
TC3: age is 6, child is not admitted

You apply mutation testing to verify if the test set is complete. What is the result of your mutation testing?

A. Based on mutation testing you determine that TC1 is superfluous, because with TC2 you already cover the equivalence class for children that don't get access.
B. Based on mutation testing you determine that an extra testcase is needed:
TC4: age is 7, child is not admitted
Because if the developer would program "IF age = 6 THEN child-is-not-admitted ENDIF" the fact that children older than 6 would not be detected by the test cases.
C. Based on mutation testing you determine that an extra testcase is needed:
TC4: age is 3, child gets access.
Since you always want two test cases for each side of the boundary, that would be 3 and 4 on one side and 5 and 6 on the other side.
D. Based on mutation testing you determine that there is a fault in the program code and you register an anomaly so that someone with a development role in the team can fix this fault.

1.26. LO30 - Selecting and combining approaches and techniques

You cannot test everything, so you need to select what to test and what not, and you also need to select the intensity of testing. What is the most important factor to make these selections?

A. Acceptance criteria.
B. Equivalence partitioning.
C. The time left in the sprint.
D. Quality risks.

1.27. LO31 - Process oriented overview

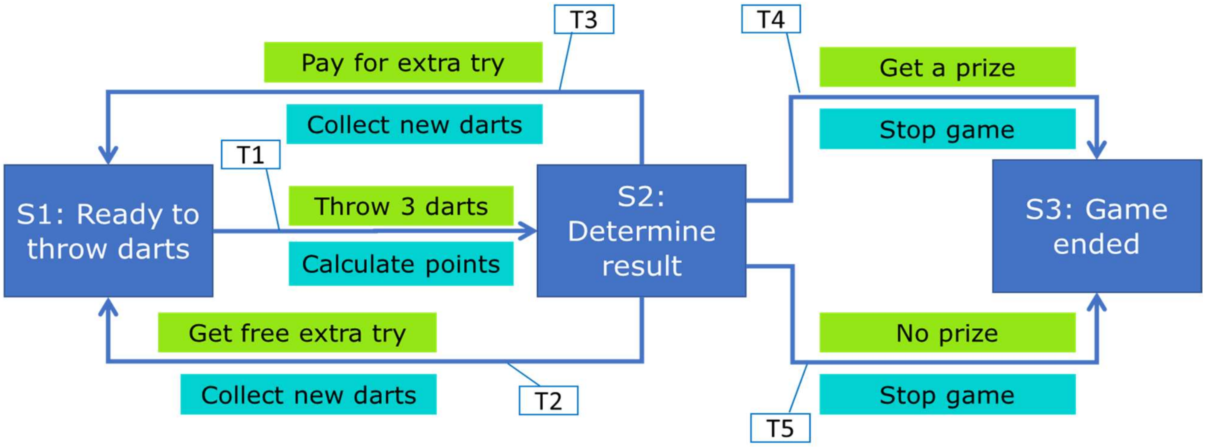
In the process-oriented coverage group we distinguish several test design techniques. Which of the following is a process-oriented test design technique?

A. Control flow testing
B. Data cycle testing
C. Statement testing
D. Abuse & Misuse cases

1.28. LO32 - Coverage types & Test Design Techniques - State transition testing

In the QualityLand game zone visitors can play a game of darts. They pay 2 QualityLand coins for a throw of 3 darts. If they throw 140 points or more, they win a prize and the game ends. If they throw 100 or more points (but less than 140) they get a free extra try. If they throw less than 100 points they can pay 1 coin for an extra try, or they can decide to stop playing without getting a prize.

The state transition diagram shows the 3 states and 5 transitions of this case.



How many test situations will you create for 0-switch coverage?
How many test situations will you create for 1-switch coverage?
Which test case(s) give (at least) 100% 1-switch coverage?

A. Number of 0-switch coverage test situations: 5
   Number of 1-switch coverage test situation: 6
   Test cases for 100% 1-switch coverage: S1-T1-S2-T2-S1-T1-S2-T4-S3
   S1-T1-S2-T3-S1-T1-S2-T5-S3
B. Number of 0-switch coverage test situations: 3
   Number of 1-switch coverage test situations: 8
   Test cases for 100% 1-switch coverage:
   S1-T1-S2-T2-S1-T1-S2-T1-S2-T4-S3
   S1-T1-S2-T2-S1-T1-S2-T5-S3
C. Number of 0-switch coverage test situations: 5
   Number of 1-switch coverage test situation: 8 (3 transitions for S1, 5 transitions for S2 and 2 transitions for S3)
   Test cases for 100% 1-switch coverage: S1-T1-S2-T2-S1-T1-S2-T3-S1-T1-S2-T4-S3-S2-T5-S3
D. Number of 0-switch coverage test situations: 3 (every state)
   Number of 1-switch coverage test situations: 5 (every transition)
   Test cases with 100% 1-switch coverage:
   S1-T1-S2
   S2-T2-S1
   S2-T3-S1
   S2-T4-S3
   S2-T5-S3

1.29. LO33 - Coverage types & Test Design Techniques - Code Coverage

You are the agile coach of a QualityLand team. Recently Felix joined the team, right after passing his university information technology exams.
Felix has just produced his first piece of code using TDD, and he very proudly tells you that he has achieved 100% code coverage.
You ask what coverage type of code coverage he refers to. Felix looks puzzled and ashamed because he doesn't know. Then he tells you that the quality risk is of the highest level and asks you what coverage type you would suggest. What is your answer?

A. You answer that line coverage is the coverage type to select.
B. You answer that path coverage is the coverage type to select.
C. You answer that statement coverage will ensure that all of the code is covered which in this case is enough.
D. You answer that 0-switch coverage would not be enough and therefore advise to apply 1-switch coverage.

1.30. LO34 - Condition-oriented test design overview

In the condition-oriented coverage group we distinguish several test design techniques. Which of the following test design techniques belongs to condition-oriented test design?

A. Path testing
B. Data Combination testing
C. Elementary Comparison testing
D. Abuse & Misuse cases

1.31. LO36 - Modified Condition Decision Coverage (MCDC)

Children can do the ball-throwing game in QualityLand. They get 2 balls and try to hit a stack of 6 cans. The rule for winning a prize is:
IF >= 2 cans are hit in the first throw AND > 4 cans are hit in two throws together OR all cans are hit in the first throw by a brother or sister of the child who is playing in another lane at the same time THEN the kid wins a prize.

The test situations are worked out in a table:

R = (A AND B) OR C

	1 (prize)			**0 (no prize)**		
A:	**1**	**1**	**0**	**0**	**1**	**0**
B:	**1**	**1**	**0**	**1**	**0**	**0**
C:	**.**	**.**	**1**	**.**	**.**	**0**

Which answer shows correct possible values for TRUE (1) or FALSE (0) on the open dot's in the last row of the table where condition C should determine the result of the decision point?

A. The possible values are:
   C: 1 1 1   1 1 0

B. The possible values are:
   C: 0 1 1   1 1 0

C. The possible values are:
   C: 0 1 0   0 1 0

D. The possible values are:
   C: 0 0 1   1 0 0

1.32. LO37 - Test design techniques - Semantic Test

Children can do the ball-throwing game in QualityLand. They get 2 balls and try to hit a stack of 6 cans. The rule for winning a prize is:
IF >= 2 cans are hit in the first throw AND > 4 cans are hit in two throws together OR all cans are hit in the first throw by a brother or sister of the child who is playing in another lane at the same time THEN the kid wins a prize.

The test situations for this decision point are worked out in a table:

R = (A AND B) OR C

	1 (prize)				**0 (no prize)**			
A:	**1**	**1**	**0**	**D1-1**	**0**	**1**	**0**	**D1-3**
B:	**1**	**1**	**0**		**1**	**0**	**0**	**D1-4**
C:	**.**	**.**	**1**	**D1-2**	**.**	**.**	**0**	

What test case is a correct logical test case for testing test situation D1-1?
(note: D1-2 is not filled in here, but was already part of the exam question for LO36)

A. The child hits 3 cans in the first throw and hits 0 cans in the second throw. The child doesn't win a prize.
B. The child hits 3 cans in the first throw and hits 5 cans in total. The child wins a prize.
C. The brother or sister of the child hits 6 cans in the first throw and the child itself hits less than 4 cans. The child wins a prize. (and the brother or sister also wins a prize!)
D. The child hits 1 can in the first throw and hits 5 cans in the second throw. The child doesn't win a prize.

1.33. LO38 - Test design techniques - Elementary Comparison Test

Children can do the ball-throwing game in QualityLand. A child can try once and when it wins a price the child can choose to collect the prize or to try again and try to get a bigger prize. The decision process is:
The child gets 2 balls and tries to hit a stack of 6 cans.

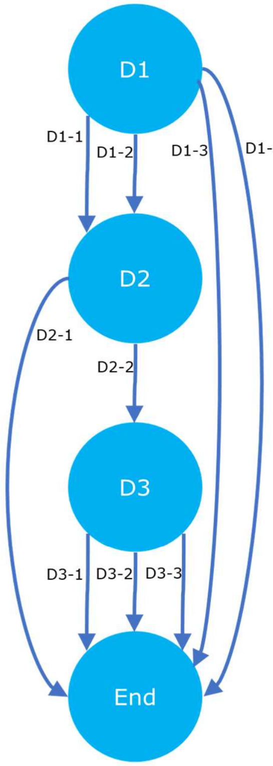
The rule for winning the initial prize is:
IF >= 2 cans are hit in the first throw AND > 4 cans are hit in two throws together OR all cans are hit in the first throw by a brother or sister of the child who is playing in another lane at the same time THEN the kid wins a prize and can decide to take another try ELSE the child leaves.

The rule for deciding on a second try is:
IF the child chooses to try again THEN go to the next step ELSE the child gets the prize and leaves.

The rule for taking the second try is:
IF the child hits all 6 cans in one throw OR the child hits at least 5 cans in both throws THEN the child gets a bigger prize ELSE the child gets a normal prize.

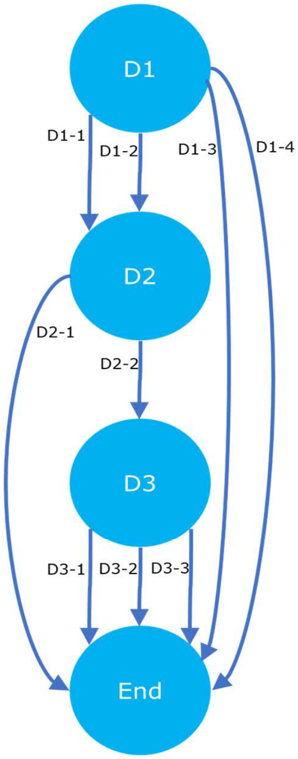
Which of the pictures shown is a correct graph of this process and how many logical test case will be needed as a minimum to test this graph?

Answer A



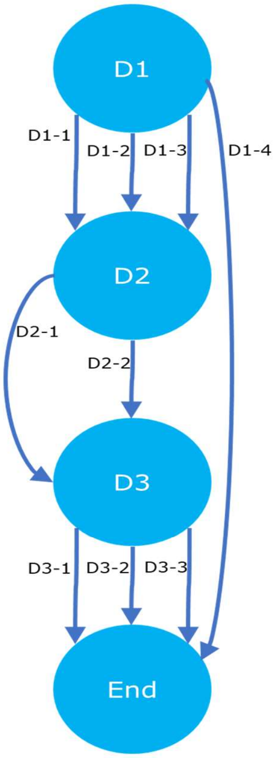
The minimum number of logical test cases is 4.

Answer B



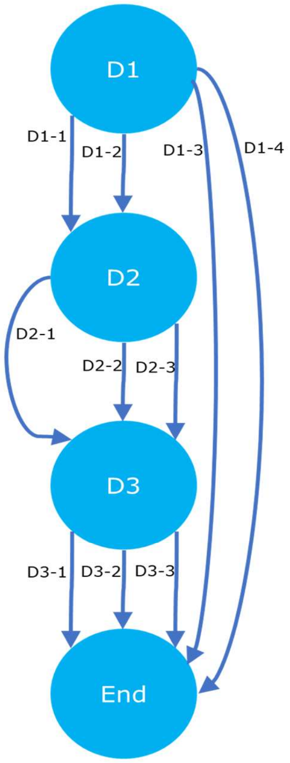
The minimum number of logical test cases is 6.

Answer C



The minimum number of logical test cases is 4.

Answer D



The minimum number of logical test cases is 5.

1.34. LO39 - Data-oriented test design overview

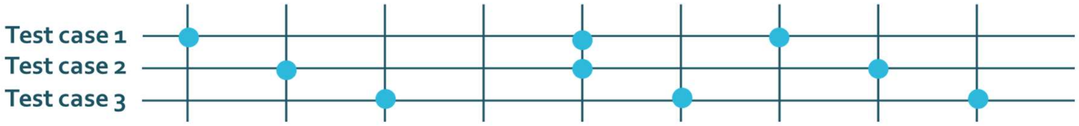
In the data-oriented coverage group we distinguish several test design techniques.
Which of the following test design techniques belongs to data-oriented test design?

A. Data Flow testing
B. Semantic testing
C. Syntactic testing
D. Path testing

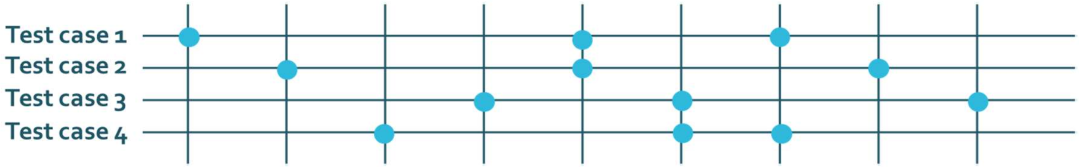
1.35. LO42 - Data Combination Test (including EP, BVA and Pairwise)

A special attraction in QualityLand is that children can dress like their favorite superhero. For this there is an app to select the outfit-items they want to wear. They can select footwear (sneakers, flipflops, high boots or low boots), a mask (full face or covering eyes only) and a hat (cap, beanie or helmet).
There is not too much time and not too much quality risk involved so you have decided that you will test this with the Data Combination Testing technique with the lowest coverage level which is to make test cases to cover at least every possible value of every data item. See the classification tree and decide what must be filled in for Test Case 3, and if there is a need for a Test Case 4 what values would be needed for that Test Case.

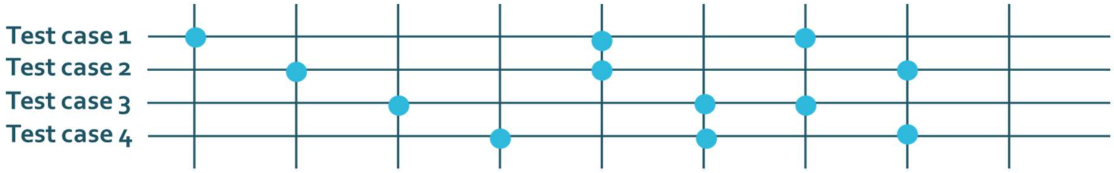
Answer A



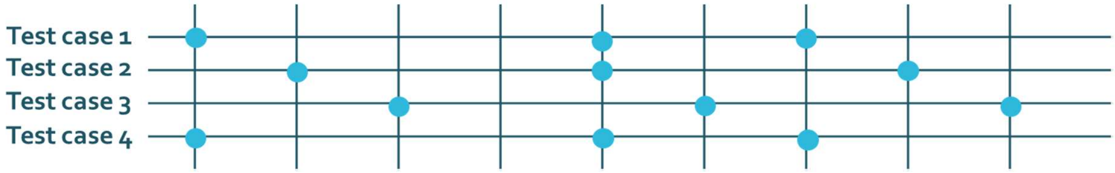
Answer B



Answer C



Answer D



1.36. LO44 - Experience based testing checklist

One of your QualityLand team members has created the below checklist for static testing whether data items comply with the data dictionary.
- Restricted choice check (e.g. Mr., Mrs., Miss)
- Presence check (mandatory field)
- Format check (check e.g. date field DD-MM-YYYY)
- Range check (check e.g. age of people 0 - 125 years)

You see this checklist is not complete. Which of the answers shows correct additions to this checklist?

A. - Calculation methods
   - Reports
   - Database functionality
B. - database accessibility,
   - server locations,
   - network diagrams,
   - protocol definition
C. - Coding standards
   - Cyclomatic complexity
   - Ratio of documentation to code
D. - Fields check for min/max length,
   - Fields check for data type,
   - Fields check for list values.

1.37. LO45 - Quality characteristics and non-functional testing

QualityLand is introducing a new attraction for kids. There are little electric boats that can be remotely controlled. The complete system (boats, charging stations, wireless communication system) is supplied by a well-known company that also gives clear evidence that the quality of the system has been thoroughly tested.
The QualityLand Product Owner has asked you to make sure that, after the system is implemented in QualityLand, the kids can safely use it and will be happy to use it.
Which quality characteristics does the Product Owner refer to?

A. Satisfaction and Freedom from risk
B. Maintainability and Intelligent behavior
C. Security and Effectiveness
D. Usability and Reliability

1.38. LO47 - Static Code Analysis with Sonarqube

Different code guidelines are used within the QualityLand development teams. The teams have defined coding guidelines that all teams need to use. What do you recommend to automatically check if code complies to these guidelines?

A. Install a tool such as SonareQube, add the code guidelines and use this static code analysis in the Continuous Integration pipeline
B. Make one team responsible for checking every code commit based on the new guidelines using a peer-review.
C. Create unit tests that verify if the code is up to standards.
D. Create an acceptance test that verifies if the code is up to standards.

1.39. LO48 - Clean architecture

What is an example of code that follows the principles of clean architecture?

A. Code that can easily be changed without having to change the interface and where separate functions are separate pieces of code.
B. Code that is as short as possible where data is exchanged in dedicated variables within the code that may be changed if the code changes. Also the functions are programmed such that as much code as possible is reused.
C. Code that is programmed in a 3d generation language follows principles of clean architecture. 4th generation programming languages usually result in much more machine-level code and thus in slower response times.
D. Clean architecture means that all user stories are specified from an end-user perspective and follow the business processes. Also a project start architecture (PSA) is important for this.

1.40. LO49 - Unit testing principles

You are one of the QualityLand IT delivery team members with a development role. The product owner asks you what kind of code units have a high cost/benefit relation, which means that the costs for testing are relatively low but the benefits are relatively high. Which is the correct answer?

A. Testing of complex code with many dependencies. Since it is complex and dependent the benefits of unit testing are high and that justifies the high costs.
B. Testing of trivial code with many dependencies. Since it is trivial and dependent the benefits of unit testing are low and that does not justify the high costs of unit testing so it is better to don't do unit testing for this category.
C. Testing of complex code with few dependencies. Since it is complex but not dependent the benefits of unit testing are high and given the low costs this is an ideal combination.
D. Testing of trivial code with few dependencies. Since it is trivial and has few dependencies the benefits of unit testing are low but since the costs of unit testing are also low, just do unit testing for this category.

2. Answers and feedback

2.1. LO01 - The VOICE model of business delivery and IT delivery

According to the VOICE model, why is "Value" a vital starting point for IT delivery?

A. By taking Value as a starting point, the team can interpret the indicators and reports using a confidence monitor.
B. By taking Value as a starting point, the users experience the real value based on the outputs and results of the system.
C. Taking Value as a starting point defines several different but coherent aspects that together will make the confidence in the business value measurable.
D. Taking Value as a starting point ensures that the focus is on the goal of IT delivery, and the people involved keep being reminded that IT delivery itself is not the goal.

A. Incorrect, this is a description of the Confidence part of the VOICE model.
B. Incorrect, this is a description of the Experience part of the VOICE model.
C. Incorrect, this describes the Objectives part of the VOICE model.
D. Correct (Book chapter 3.2)

2.2. LO05 - Cross-functional teams

How does a cross-functional team in high-performance IT delivery work more effectively than a multi-disciplinary team?

A. A cross-functional team consists of specialists that are very good at one task and work in silos which is the most efficient way of working.
B. A cross-functional team stives to automate as many tasks as possible and therefore are more efficient than multi-disciplinary teams.
C. Because the people in the cross-functional team are prepared to pick up any task, the team is able to still function when one of the team members is temporarily unavailable.
D. The people in the cross-functional team select a role based on their skills and the tasks on the backlog and they keep the same role during the entire sprint. Therefore they will be more effective than a multi-disciplinary team where team-members always have the same function.

A. Incorrect
Working in silo's is per definition not cross-functional. Also, this answer doesn't describe about effectiveness and therefore doesn't answer the question.
B. Incorrect
Although a cross-functional team indeed strives to automate as many tasks as possible this doesn't directly make the team more effective than a multi-disciplinary team. Automation mostly contributes to efficiency and also multi-disciplinary teams can also apply automation.
C. Correct
See book section 2.2 introduction
D. Incorrect
The people in the cross-functional team can switch roles many times during a sprint, so they don't choose a role just once per sprint.

2.3. LO06 - CI/CD pipeline

Which of the following quality engineering activities is performed during the Team test stage of a CI/CD pipeline?

A. Deploying the software package to the test environment.
B. Merging all features from various branches.
C. Monitoring the behavior of the testing system.
D. Running automated unit tests.

A. Incorrect
   This happens in the Prepare for Business test stage.
B. Incorrect
   This happens in the source stage.
C. Incorrect
   This happens in the Production/Monitoring stage.
D. Correct
   see Book chapter 6.1.

2.4. LO07 - Capabilities

The IT manager of QualityLand wants to support automation of most tasks that the DevOps teams need to perform. Therefore she has decided to implement a new CI/CD pipeline. She asks you to tell her which tools are now in use and what tools are needed extra to those existing tools so that the pipeline can be constructed.
What is your action and/or advice?

A. You make an inventory of all existing tools. You search for examples of CI/CD pipelines of other companies (that are similar to QualityLand) and based on that you make a complete list of the tools needed.
B. You tell the IT manager that implementing DevOps does not mean that a CI/CD pipeline is needed and that also automation of tasks is not very important since the team members are very good at their job and there have not been complaints so far about the use of the tools that are currently in use.
C. You ask the IT manager, the team members and other people involved in IT delivery about the capabilities that are needed in the pipeline. Based on these capabilities you determine which existing tools would fit in and what new tools need to be implemented.
D. You investigate the capabilities of the team members to see with which of the existing tools they can easily work. Then you contact an external consultant to make an independent selection of tools for the CI/CD pipeline.

A. Incorrect
You should first investigate the capabilities needed to define the pipeline and then select tools that meet the capabilities. Not all existing tools are likely to be used in the pipeline.
B. Incorrect
In DevOps, continuous everything is the starting point, which involves implementing a CI/CD pipeline (see section 9.2.4 of the book)
C. Correct
See book section 6.3 and 6.4.
D. Incorrect
The capabilities relate to what the tools are capable of, not to what the team members are capable of.
In this case there is no reason to believe that an external consultant is needed to make the selection of tools. Also there is no need for an independent selection.

2.5. LO08 - Introduction QA & testing topics

What is the correct description for the Performing topic "Quality measures"?

A. Stakeholders will want to know if the QA and testing tasks are performed in an effective and efficient manner. Therefore they must be defined.
B. Based on the acceptance criteria, decisions are made on the relevant quality measures.
C. For specific user needs it must be clear when they are fulfilled.
D. The quality measures describe how the investment in QA & testing activities is balanced over the test object.

A. Incorrect
This a description of metrics.
B. Correct
Book chapter 13.1
C. Incorrect
This describes the Acceptance criteria topic.
D. Incorrect
This describes the Test strategy topic.

2.6. LO09 - Monitoring & control

The PO (Product Owner) of the QualityLand DevOps team wants to monitor the progress of the delivery of new software features by the team. She is unsure which of the following indicators she should use:
- Market share increase
- Functional components done compared to defined
- Quality of the refinement process

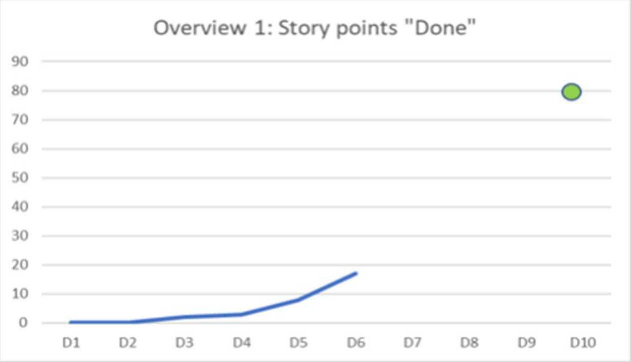
Which option would you advise her?

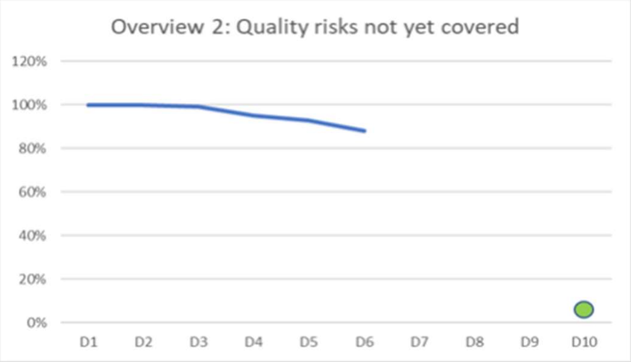
A. Market share increase
B. Functional components done compared to defined.
C. Quality for the refinement process
D. All options, because this will give even more insight in the progress of delivery of features.

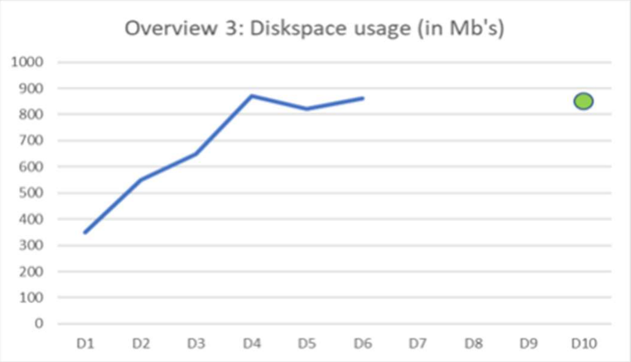
A. Incorrect
This is a business value related indicator that doesn't give direct insight in progress of IT delivery.
B. Correct
This is an IT delivery related indicator. See section 4.1 in the book
C. Incorrect
This is a team related indicator that shows how the IT delivery process performs. It doesn't have a relation with the progress of delivery of features.
D. Incorrect
Only Functional components done compared to defined gives insight in the progress of IT delivery. The others don't, see the explanation of the other answers.

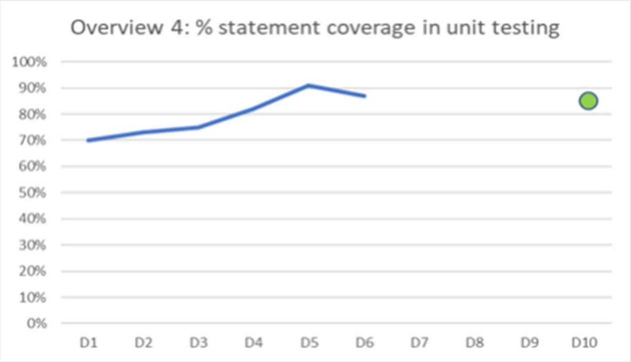
2.7. LO10 - Reporting and alerting

Your cross-functional team is working in a sprint that has 80 story-points of tasks on the backlog. Four indicators are used to track progress and give insight to everybody involved. The indicators are visualized in four overview-reports that are shown with this question. Your team is at the start of day 7 of the 10-day sprint and in the standup-meeting you must briefly comment on the forecast of whether your team is likely to meet the targets (targets are indicated with green dots).
What is your summary about the status?


Overview 1: Story points "Done"


Overview 2: Quality risks not yet covered


Overview 3: Diskspace usage (in Mb's)


Overview 4: % statement coverage in unit testing

A. We have had a very slow start this sprint because of problems in our pipeline tooling. Therefore we could not merge any code in the main branch and it is unlikely we will make up for that, looking at story points done and quality risks covered.
The use of diskspace must be balanced and we have quickly found this balance and expect to maintain the targeted level.
Our goal of 85% statement coverage with our unit test cases was reached and we are confident we can maintain this.

B. Although we had a slow start this sprint it is normal that at 60% of the sprint only 20% of the work is done, we can easily make up for this in the remaining 4 days of the sprint.
We are worried about the diskspace usage because the target of 850 Mb is very close to 1 Gb.
The target for statement coverage can most likely not be met, therefore we propose to turn to line coverage which would give us more confidence.

C. All graphs show that we are in deep trouble. The story points "done" are our only light in the tunnel because we think we can still manage to finish the remaining software. However we won't be able to test all software before the end of the sprint so the risks not covered will remain high and the statement coverage will keep dropping like the trend already shows.
   The diskspace usages is the least of our worries.
D. The graphs of Story points "done" (burn-up) and "Quality risks not covered" (burn-down) clearly show that the product owner has forced our team to put way too many user stories on the backlog because we will never be able to meet the target.
   We have already ordered extra hard-disks because the graph of the diskspace usage shows that with this limited amount of software the usage already goes "through the roof".
   The only positive graph is statement coverage so therefore we propose to improve the unit testing coverage to line coverage.

A. Correct
   This interpretation of the overview reports is the most likely of all answers.
B. Incorrect
   Although in sprints a slow start is not uncommon, this situation, with only 20% ready at 60% of the time is worrying and would definitely need extra investigation.
   Why would you worry about the diskspace usage when it is clearly moving around the target. There is no information that 1 Gb would be a limit, it's just the end of the graph.
   Line coverage never gives more confidence than statement coverage so although the line coverage percentage would be higher the confidence would be less.
C. Incorrect
   If the team rushes to finish remaining software but isn't able to test it, that would mean these story points will not get the status "done" (because done means a test has shown the acceptance criteria are met) so the target wouldn't be reached.
   In that case it is true that risks not covered remains high.
   That the diskspace usage is not worrying is true.
   There is no direct relation between the number of user stories tested and the statement coverage level, because statement coverage is only measured for the tests that have been executed (so it is not related to the total amount of functionality).
D. Incorrect
   To start with, if a team is forced by the product owner to put more user stories on the backlog than their velocity would make feasible, this shows there at least is no mature relationship between team and product owner.
   When the operational indicator of diskspace usage reaches the target this doesn't seem like a negative thing, it is likely to mean that the team does well and indeed the diskspace usage is OK.
   Although the statement coverage is not very bad, it also isn't as good as it could be, but the suggestion to improve by using line coverage simply is incorrect, line coverage gives less confidence than statement coverage.

2.8. LO11 - Infrastructure

The QualityLand DevOps team is about to implement a new IT system, this includes implementation and configuration of the infrastructure. The team uses cloud infrastructure that is defined as Infrastructure as Code (IaC) using Terraform.
The Scrum master is new to the team and has no experience with IaC. He ask you how you will verify that the IaC indeed complies with the requirements and needs of QualityLand.
What do you explain to the Scrum master?

A. You explain to the Scrum master that in QualityLand a virtual team will be created with a end-to-end quality orchestrator and members from all teams involved that will organize and perform an end-to-end regression test for the IT system and the business process that it supports.

B. You explain to the Scrum master that Terraform is a Domain Specific Language (DSL) that is used to specify what infrastructure needs to be supplied to support the business process. Using IaC enables easy extension of infrastructure when the needs for infrastructure increase.
All people that create Terraform code within QualityLand follow the common guidelines and practices that are also used for other pieces of code, such as modularization, versioning, repeatability, security compliance and code reviews.

C. You explain that parts of the infrastructure verification will take place in all fundamental DevOps activities. For example in the Plan activity you validate the architectural design, in the Code activity you verify the syntactical correctness, in the Integrate activity you assess aspects like security certificates and database configuration, in the Deploy activity you focus on stability, performance etcetera and in the Operate and Monitor activities monitoring is used to collect feedback from live operation.

D. You explain that infrastructure verification is a key activity of the team member with the business analysis role. This person will check if the IaC that has been specified is sufficient to support the business process.
Also you explain that with IaC there is no need for checking technical details (such as correct ports, firewall rules, security certificates, assigned diskspace, OS version, etc.) because Terraform will automatically deploy this.

A. Incorrect
Infrastructure verification is NOT an objective of end-to-end regression testing.
See section 7.1 of the syllabus for more information about infrastructure verification.

B. Incorrect
Although everything stated here is correct about Infrastructure as Code, it does not answer the question how the Infrastructure Verification is done.

C. Correct
See section 7.1.2 of the syllabus.

D. Incorrect
The examples given are all examples of attributes that need to be checked during Infrastructure Verification.
Also Infrastructure Verification activities need to be done in all fundamental DevOps activities, and certainly not just by the person with the business analysis role.

2.9. LO12 - Metrics

The QualityLand DevOps team wants to improve their IT delivery process in the CI/CD pipeline in order to improve their velocity (and thus lower the costs per story point).
To measure the improvement two metrics need to be defined.
Which of the following metrics can be used to measure the improvement?

A. 1) Fault density
   2) Anomaly detection effectiveness
B. 1) Savings achieved by reusing test products
   2) Percentage of test costs
C. 1) Percentage of automated tests related to risk coverage
   2) Percentage of appropriate use of testing techniques
D. 1) Savings of the test
   2) Percentage of code coverage

A. Incorrect
   1) is an efficiency metric but this is not related to improving velocity.
   2) is an effectiveness metric that is related to whether faults are detected as early as possible.
B. Correct
   These are both efficiency metrics that relate to total costs of testing related to the costs of the IT delivery process as a whole.
   See tables 24.1 and 24.2 in section 24.4.
C. Incorrect
   1) Automation may indeed increase velocity but this metric is mainly about whether the risk coverage is OK, not to increase velocity
   2) Test design techniques can help to improve velocity but this is not directly related to lowering costs.
D. Incorrect
   1) is an efficiency metric but this is mainly focused on demonstrating what would have been the costs if there would be no testing, so not directly related to lowering the costs.
   2) This is an effectiveness metric that mainly relates to the number of test cases related to the volume of the code.

2.10. LO13 - Continuous improvement

Henrik, the Scrum master, is very happy with the current maturity of your DevOps team. But he already warns you that in this everchanging world a status quo actually means going backward. To make sure the team stays up to date he wants you to implement continuous improvement and asks you to propose an approach for this.
What is your proposal?

A. You propose to apply the Deming cycle. This means that first you analyse the current situation and develop ways to improve, then you test one or more alternatives, you determine whether the trial is working as intended (if not, revisions are needed or the alternative is scrapped) and if the improvement works satisfactory then it is implemented.

B. You propose to apply the Quality to Activity Mapping approach. This gives substance to six pre-defined Quality Key Areas (QA awareness, QA & Testing, Governance, Transparency, Automation and Infrastructure).
This table supports the improvement of the QA & Testing skills of the people in the team.

C. You explain to Henrik that you will implement the fundamental activities (Plan, Code, Integrate, Deploy, Operate and Monitor) that will help to solve inefficiencies within the systems manufacturing process.

D. You explain to Henrik that to implement an improvement culture there needs to be focus on Product (quality of the application), Process (DevOps QA&Testing activities) and People (QA & Testing skills). To cover all these aspects you propose to implement descriptive analytics.

A. Correct
This is the correct way to implement the Plan, Do, Check, Act of the Deming Cycle. See book section 25.2.4

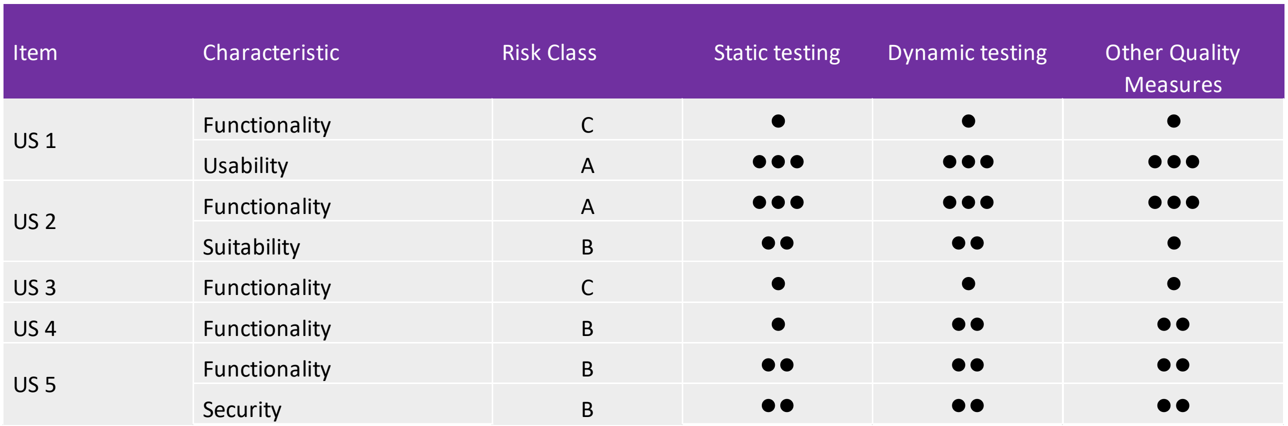
B. Incorrect
Quality to Activity Mapping is an approach to improve the QA & testing activities, so it can be part of the continuous improvement activities, but not for everything.
And QAM is NOT about the QA & Testing SKILLS of the people in the team, that is the Quality to People Mapping (QPM).

C. Incorrect
The fundamental activities are described in the DevOps infinity loop and in general DevOps will indeed solve inefficiencies in the systems manufacturing process. However DevOps in itself is not an approach for continuous improvement.
(see book section 9.2)

D. Incorrect
Indeed Product, Process and People are the aspects that all need attention in a continuous improvement culture.
However Descriptive analytics is just a way of providing insight into what has happened and is happening, but it is not an approach to improvement. (see section 17.1.5.

2.11. LO14 - Quality risk analysis & test strategy

Select a possible quality measure, test approach or test design technique to dynamically test the functionality for US3.



Item	Characteristic	Risk Class	Static testing	Dynamic testing	Other Quality Measures
US 1	Functionality	C	●	●	●
	Usability	A	●●●	●●●	●●●
US 2	Functionality	A	●●●	●●●	●●●
	Suitability	B	●●	●●	●
US 3	Functionality	C	●	●	●
US 4	Functionality	B	●	●●	●●
US 5	Functionality	B	●●	●●	●●
	Security	B	●●	●●	●●

A. Data Combination Test (with coverage of all combinations of all classes)
B. Technical review
C. Exploratory testing
D. Pair programming

A. Incorrect
This is a dynamic test design technique but coverage of all combinations of all classes is the highest level of coverage which doesn't match with the risk class C and one bullet for test intensity.
B. Incorrect
This is a technique for static testing
C. Correct
This is a test approach for dynamic testing and it can be applied with a risk class C and a 1-bullet test strategy. (chapter 26, 35 and 47)
D. Incorrect
Pair programming is a quality measure that improves the quality during the DevOps "Code" activity but it is not specifically focused on the dynamic testing of functionality. (see section 35.4 of the book)

2.12. LO15 - Acceptance criteria

Your fellow team member Kamlesh has written acceptance criteria in Gherkin style before coding has started. You pick up the task from the scrum board (in the role of tester) to review, verify and accept these criteria. Of course you use the seven tips of Ravlani.
What is your conclusion about these two acceptance criteria?

Given the QualityLand visitor wants to know the waiting time for a roller coaster
When she wants to select which roller coaster
Then a list must be presented with the fairyland roller coaster and the high-rock roller coaster.

Given the QualityLand visitor wants to know the waiting time for the fairyland roller coaster
When she uses the mobile app
Then the response must be fast enough for the average user.

A. Your conclusion is that both acceptance criteria comply with all tips. However you would advise to delete the second acceptance criterion because usually mobile apps will be fast enough anyway and testing this would cost a lot of effort for the team which can be better spent on other activities.
B. Your conclusion is that the first acceptance criterion complies with all tips of Ravlani (for as far as you can see within the scope of this case) and the second acceptance criterion does not comply with the tip of having a clear pass/fail result. Also you as a team member shouldn't be the only one to verify the acceptance criterion, the Product Owner must verify.
C. Your conclusion is that both acceptance criteria do not comply with all 7 tips because they are not independently testable (tip 3) and because the acceptance criteria cannot be written after finishing the program code and implementing the user story.
D. Your conclusion is that the first acceptance criterion is OK.
The second acceptance criterion is as good as it gets because if you would elaborate further then tip 5 (focus on what, not on how) would be violated, especially when exact performance criteria would be given.

A. Incorrect
It is never a good idea to delete an acceptance criterion because the team doesn't have enough time to test it.
Further see the explanation with the correct answer.
B. Correct
Tip 1 can't be properly checked in this short case.
Tip 2 is complied with
Tip 3 can't be properly checked in this short case.
Tip 4 is NOT complied with ==> "fast enough" is not a clear pass/fail criterion.
Tip 5 is complied with
Tip 6 is complied with
Tip 7 is NOT complied with ==> the product owner should verify acceptance criteria, not just a team member.

See book chapter 27 introduction.

C. Incorrect
   These two acceptance criteria can very well be tested independently, the first is a functional test, the second is a performance test.
   Indeed acceptance criteria must be written before the implementation of the user story, and in this case states "before coding has started" so this tip is complied with.
   For further explanation see the correct answer.
D. Incorrect
   Indeed the first acceptance criterion is OK.
   The second acceptance criterion should have clear pass/fail criteria (tip 4) and these can perfectly be elaborated by focusing on the "what" without stating the "how".
   For further explanation see the correct answer.

2.13. LO16 - Reviewing

A new Product Owner has recently joined your DevOps team. He has a lot of experience in amusement parks but doesn't have any experience with DevOps. While you are working together on the user stories you mention to the Product Owner that you will apply the four amigo's approach.

One of the new user stories is described as:
The new Virtual Reality (VR) attraction uses simple cardboard goggles in which the QualityLand visitors insert their own smartphone and then get the VR experience. This attraction shows a stereo-video and must be compatible with all major smartphone operating systems.
The Product Owner listens in on the four amigo's session of your team and is surprised by the in-depth discussion between the team members. After the session he asks you to explain why this review technique involves discussion instead of just mentioning anomalies if these are observed.

What do you explain to the Product Owner?

A. You explain that whenever a deliverable is reviewed the four amigos study the deliverable and then exchange their views to get a common understanding of the user story which will result in a better final version of the user story.
   In this example (with a new VR attraction) the team members will discuss specifically the non-functionals of this new attraction because there is little experience with this new technology.
B. You explain that the n-amigo's approach means that all team members will behave in a friendly way and leave room to each other to express their own ideas and feelings. After that the Scrum master will decide what is the best approach to implement this new user story which by the way basically is a functional challenge because the show must meet the look-and-feel of QualityLand.
C. You agree with the Product Owner that there is too much talking in your team and therefore you propose to the product owner to join forces to convince the team members that it is far more efficient and effective for the team to implement

Inspections as a formal review technique.
In this specific example with the VR attraction the advantage of a formal inspection will be that all roles involved can do their own individual review and this way the highest number of anomalies can be detected. After all anomalies have been collected the author of the user story can improve the story.

D. You explain to the Product Owner that DevOps is a whole-team approach in which normally everybody in the team is involved in all discussions about user stories, but because the team is behind on schedule they have decided to scale down to the four amigo's approach so that only four team members are involved and other team members can pick up other tasks.

A. Correct
See 29.1.1.2 in the book.

B. Incorrect
The word amigos doesn't refer to friendliness of the people involved.
Also a Scrum master never is the person to decide about implementing user stories.
Finally with VR the non-functionals will at least be as important as the functional quality characteristics.

C. Incorrect
Formal inspections are usually not applied in DevOps (book 29.1.2) and this way of reviewing will not contribute to common understanding between team members because the do individual reviews.
The main advantage of the n-amigos approach is in the exchange of views.

D. Incorrect
The four amigo's approach is not just an alternative to whole-team working. The four amigo's approach has always been meant to include all various roles in the discussions without involving the whole team.

2.14. LO17 - Pull-requests

Children often want to buy some candy for themselves in QualityLand.
Their parents give them some pocket money, in this case 1 euro.
Every piece of candy costs 50 cents.
This piece of code (in Python language) calculates if the child has enough money to buy a piece of candy.

```
candy = 0.50

class Person:
def __init__(self):
 ""Sets the money available""
self.money = 1

def calc_pers_money(self, money):
    ""Calculate if the visitor has enough money available for candy""
    money_left = money - candy
    if money_left >= 0:
        print("You can buy candy")
    else:
        print("You don't have enough money")
```

You're assigned to review the code as part of the pull request. Use the following checklist:
1. method names may not be longer than 15 characters (a method is indicated by "def")
2. lines within a method must have indentation (one tab or 4 spaces at the start of each line)
3. method names should be snake_case (lower case and underscores _)
4. methods should contain docstrings (comments starting with "")

Does the code above meet the requirements of the checklist?

A. Yes, the code complies with all rules from this checklist, so the code can be pulled into the main branch.
B. No, the code does not meet all criteria from the checklist. Not all of the code uses indentation, so the code cannot be pulled into the main branch.
C. No, the code does not meet rule 2 (indentation) and rule 3 (snake_case), so the code cannot be pulled into the main branch.
D. No, the code does not meet rule 1 and rule 4 of the checklist so the code cannot be pulled into the main branch.

A. Incorrect
The code does not comply with the rule for indentation. (see correct answer)
B. Correct
The two lines after "def __init__(self):" should have had an indentation of one tab or 4 space characters.

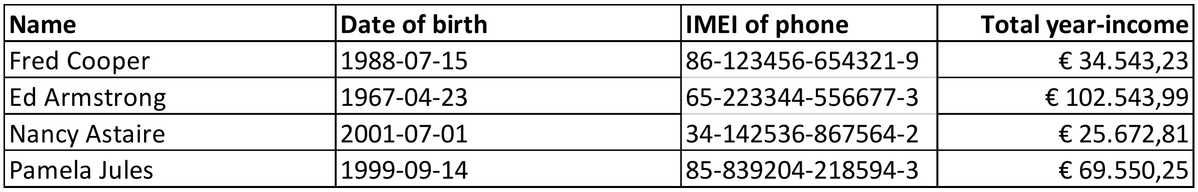
The code does comply with the other rules from the checklist.
Also see book 29.1.1.1

C. Incorrect
Indeed there is no indentation in part of the code. But all method-names are written in snake_case so that is not a violation of rules.

D. Incorrect
There are no long method-names and there are comments that start with "". Further see explanation of the correct answer.

2.15. LO18 - Test data management

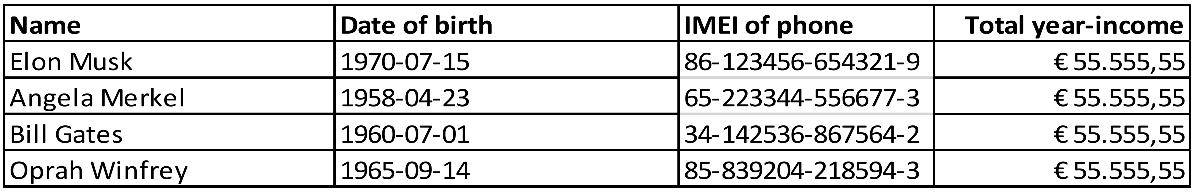
The QualityLand team wants to use data from the production system in the test environment. One of the team members has applied data scrambling and rule-based masking. Based on the data in the original table she has created four data sets.



Name	Date of birth	IMEI of phone	Total year-income
Fred Cooper	1988-07-15	86-123456-654321-9	€ 34.543,23
Ed Armstrong	1967-04-23	65-223344-556677-3	€ 102.543,99
Nancy Astaire	2001-07-01	34-142536-867564-2	€ 25.672,81
Pamela Jules	1999-09-14	85-839204-218594-3	€ 69.550,25

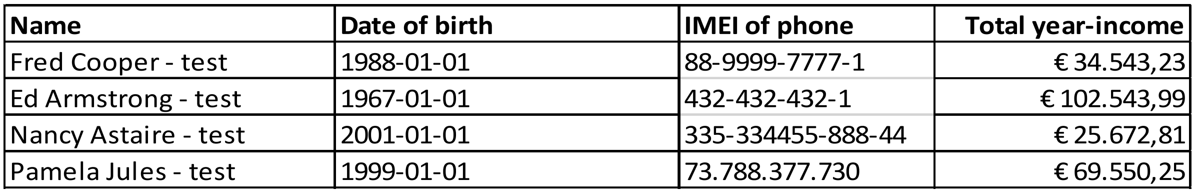
Which of these data sets has been correctly masked?

A.



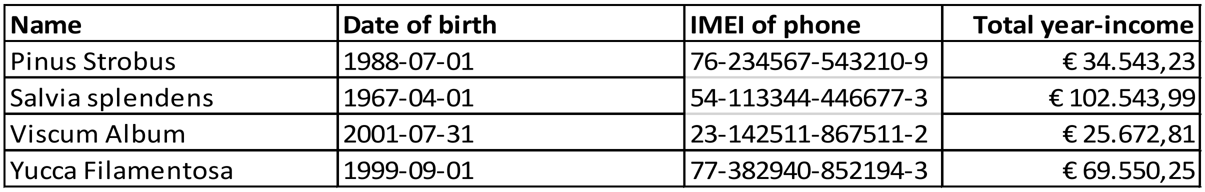
Name	Date of birth	IMEI of phone	Total year-income
Elon Musk	1970-07-15	86-123456-654321-9	€ 55.555,55
Angela Merkel	1958-04-23	65-223344-556677-3	€ 55.555,55
Bill Gates	1960-07-01	34-142536-867564-2	€ 55.555,55
Oprah Winfrey	1965-09-14	85-839204-218594-3	€ 55.555,55

B.



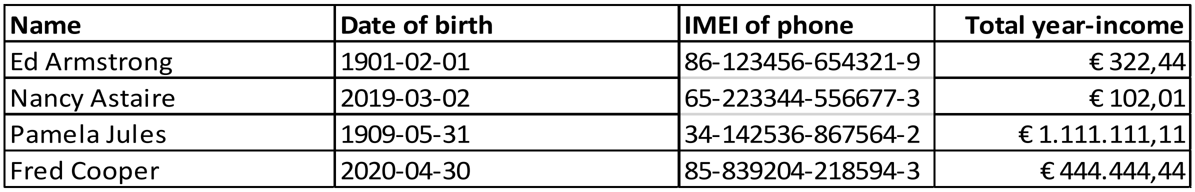
Name	Date of birth	IMEI of phone	Total year-income
Fred Cooper - test	1988-01-01	88-9999-7777-1	€ 34.543,23
Ed Armstrong - test	1967-01-01	432-432-432-1	€ 102.543,99
Nancy Astaire - test	2001-01-01	335-334455-888-44	€ 25.672,81
Pamela Jules - test	1999-01-01	73.788.377.730	€ 69.550,25

C.



Name	Date of birth	IMEI of phone	Total year-income
Pinus Strobus	1988-07-01	76-234567-543210-9	€ 34.543,23
Salvia splendens	1967-04-01	54-113344-446677-3	€ 102.543,99
Viscum Album	2001-07-31	23-142511-867511-2	€ 25.672,81
Yucca Filamentosa	1999-09-01	77-382940-852194-3	€ 69.550,25

D.



Name	Date of birth	IMEI of phone	Total year-income
Ed Armstrong	1901-02-01	86-123456-654321-9	€ 322,44
Nancy Astaire	2019-03-02	65-223344-556677-3	€ 102,01
Pamela Jules	1909-05-31	34-142536-867564-2	€ 1.111.111,11
Fred Cooper	2020-04-30	85-839204-218594-3	€ 444.444,44

A. Incorrect
   - Names replaced by names of existing people - not good
   - Date of birth, year scrambled - good (in combination with changed name)
   - IMEI number not changed, GDPR sensitive - not good
   - All year-incomes equal, not distinctive for testing - not good

B. Incorrect
   - Names masked by adding a word, but not depersonalized - not good

- All dates of birth 1 January - not realistic
- IMEI numbers randomly scrambled but not rule-based masked - not good
- Total year-income unchanged, not GDPR sensitive - good

C. Correct
- names replaced by latin plant names - good
- date of birth changed to first or last of month, age still usable - good
- IMEI numbers masked rule-based - good
- Total year-income unchanged, not GDPR sensitive - good

D. Incorrect
- names just scrambled but not depersonalized = not good
- date of birth changes to unrealistic values - not good
- IMEI numbers unchanged, privacy issue - not good
- total year-income changed but unrealistic - not good

2.16. LO19 - Test automation

A new team member joins your team at QualityLand and the DevOps culture with its CI/CD pipeline is still new to him. He asks you to what extent you have implemented the "everything as code" automation principle.
You answer that you have implemented this principle as much as possible and you give an example to prove this. Which is the example you give?

A. You explain that additionally to automated testing you also create exploratory testing charters to make sure that the people involved have a personal chance to establish their confidence in the IT system.
B. You explain that even the documentation is implemented as documentation as code. Using a common markup language (in your team that is Doxygen) this enables aligning the versioning of the software and documentation.
C. You explain that to establish quality at speed automation is inevitable and therefore your team has implemented test orchestration to elimination "islands of automation".
D. You explain that as part of the continuous testing the team is moving towards auto-generation of test cases, to reduce workload on creating test cases. You use model based testing tooling for this.

A. Incorrect
Although exploratory testing is a very useful part of quality engineering it is not related to "everything as code" automation.
B. Correct
See book section 32.6
C. Incorrect
Although test orchestration is very useful and indeed contributes to eliminating islands of automation, it is not an example of implementing everything as code automation.
See book, section 32.4
D. Incorrect
Although auto-generation of test cases using model based testing tooling is a very good thing, it is not an example of everything as code automation.
See book section 32.2

2.17. LO20 - Test execution

In your DevOps team at QualityLand a new feature is in the team test stage. Another team member has prepared test cases based on the acceptance criterion "functional correctness" that is marked on the story card.
You notice that "usability" is also marked as an acceptance criterion on the story card but no test cases are created for this yet.
The Product Owner tells you that the feature will only be used by the QualityLand employees and they will all get training before they start using the feature, so this feature is low risk.
How will you execute the test for the new feature?

A. You create extra test cases to explicitly test for usability. Since it is low risk you only create five test cases to prevent too much testing effort.
When this test preparation is ready you execute both the test cases for functional correctness and for usability and register the results.
B. You create a test automation script so that the test cases that were created for functional correctness can be automatically run. The advantage of automating the test execution is that usability aspects will also be observed by the test automation tool. Based on the output of the test automation tool you register the results for further investigation and assessment.
C. You execute the test cases for functional correctness (that were previously prepared). Since usability is not important you ignore this acceptance criterion.
D. You execute the test cases for functional correctness (that were previously prepared) and during test execution you implicitly test the usability of the feature. For this you have retrieved the usability checklist that was created long ago for this purpose.

A. Incorrect
Since it is low risk it is better to do implicit testing. Also the number of 5 test cases appears to be totally random, why would 5 test cases align with a low risk. Besides that, it is very difficult to make explicit test cases for usability, using a checklist while doing an implicit test makes more sense.
B. Incorrect
Automated test execution by definition only does explicit testing, so no implicit testing of usability aspects will be done by the test automation tool.
C. Incorrect
Although usability is not high risk still some implicit testing is needed because there is an acceptance criterion for it.
D. Correct
Since usability is not high risk there is no need to make explicit test cases, implicit testing based on a checklist will be fine. See book chapter 33.

2.18. LO21 - Investigate & assess outcome

When booking a stay at the QualityLand hotel, guests can get 10% discount if they book 3 or more rooms in the same transaction.
In the role of developer Uzgur has created an app which contains this piece of code:

```
IF number-of-rooms > 3
THEN MOVE “10% discount” TO status
ELSE MOVE “no discount” TO status
ENDIF
```

In de role of tester, Subba made the following test cases:

TC1: number-of-rooms = 1, expected outcome “no discount”
TC2: number-of-rooms = 2, expected outcome “no discount”
TC3: number-of-rooms = 3, expected outcome “10% discount”
TC4: number-of-rooms = 4, expected outcome “10% discount”

The people in the team who have development skills currently are all very busy and won't have time to do immediate fixes if that would be needed.

You execute the tests. What is the outcome and what steps do you take?

A. Test case 3 fails.
You investigate the fail and conclude that the code doesn't comply with the requirement.
Since there is no team member available who can fix this fault immediately, you gather evidence, reproduce the fault, make sure that indeed the test cases are correct, create an anomaly report in which you register that the fault is in the code. You ask another team member to review the anomaly and after this it is put on the teams backlog.

B. All test cases are good and since you are responsible for having correct test cases your job is done.
You register that the quality risk is properly covered so the stakeholders can have confidence in the pursued business value.

C. Test case 3 fails because the code should have been "IF number-of-rooms >= 3".
Since all team members with development skills are busy you send a text-message to the mobile phone of one of the team members with development skills to ask her to fix this as soon as she has time.

D. Test case 3 fails.
You investigate the fail and conclude that the test case must be wrong since Uzgur is the most experienced developer in the team and Subba only just started in the team and doesn't have much experience.
Since there is no team member available who can fix this fault immediately, you change the test to:
TC3: number-of-rooms = 3, expected outcome “no discount”
You execute the test again and report the quality risk is covered.

A. Correct
   See book, especially section 34.2
B. Incorrect
   Although the test cases in itself are good, you did not execute the test cases so there is no reason to report that the risk is covered.
   If you would execute the test cases then test case 3 would fail.
C. Incorrect
   If the fault is not fixed immediately the anomaly must be registered so that the steps to fix and retest can be properly followed and the information about the anomaly is not lost. Sending a text-message to a mobile phone does NOT qualify as proper registration of an anomaly.
D. Incorrect
   Even the most experienced person sometimes makes an error which causes a fault in the code.
   So here the conclusion of the investigation should be that the code is wrong.

2.19. LO22 - Quality measures

While discussing useful and practical quality measures to be used in the next sprint within your DevOps team, you state that it is of vital importance that the various quality measures are cohesive.
Greg, your fellow team member, asks you to explain why this is so important.
What is your answer?

A. In TMAP there is a specific list of 10 quality measures that, if all of those are applied, will guarantee that quality engineering is successfully implemented.
B. No single quality measure is an independent activity, it is only a small cog in the quality management wheel. And quality assurance is, in the end, only one dimension of quality engineering.
C. The quality measures must be cohesive which means that you choose between preventive, detective or corrective quality measures so that the selected quality measures aim for the same effect.
D. Based on the DevOps activity you are involved in (such as Plan, Code, Integrate, Deploy, Operate or Monitor) you select the QA & Testing topic that is specifically related to that activity. Then select the quality measures that belong to that Topic to ensure having cohesive quality measures.

A. Incorrect
The 10 quality measures that are described in chapter 28 and chapter 35 are important, however, you do not need to apply all 10 in every situation, and (more important) many more other quality measures can also be applied.
B. Correct
See section 28.2 of the book.
C. Incorrect
Quality measures indeed can be divided in preventive, detective and corrective measures, but these should be combined when implementing effective and efficient quality engineering, so you don't choose just one of these groups.
D. Incorrect
The QA & Testing topics don't have a 1-on-1 relationship with the fundamental DevOps activities (section 14.2 of the book) and quality measures don't have a 1-on-1 relationship with a QA & Testing topic, but are usable for various activities. (chapter 28)

2.20. LO23 - Specification and Example

The QualityLand fast-food restaurant has a mobile app for ordering food. To support a healthy lifestyle the app gets a new feature that counts the calories of the food items that the user selects. The app should give a warning if the calories exceed 900 for a woman and 1100 for a man.
Your team works in a timeboxed session to capture the information about this feature of the app and you have created an example map as shown.

Feature The food-ordering app gives a warning if the calories of the selected food-items exceed limits.			
Rule 1 For a woman the warning-limit of calories is 900. For a man the warning-limit of calories is 1100.	**Rule 2** A person that orders for multiple people must indicate how many women and men.		
Example 1 A woman that only orders one icecream-cone gets no warning.	**Example 3** A person that orders for multiple people will get a warning if the total calories exceed the total limit.	**Example A** If the order is for a child no warning will be given (because this differs too much to be reliable)	**Question X** How does the app know if the person is a woman or a man or a child?
Example 2 A woman that orders two complete hamburger-meals including extra sauce gets a warning-message.	**Example 4** A man that orders meals for himself and two women will get a warning message if the calories exceed 2900.		**Question Y** How does the app know the number of calories for each individual product?

You have thought of 1 additional example (A) and two questions, X and Y. What must be done with these examples and questions?

A. Example A is added to Rule 2.
   Question Y is not registered because the product owner has the opinion that this is a technical detail.
   Question X is not registered because it can be answered on the spot.
B. Example A is added to Rule 1.
   Question X and Y are deleted because the product owner answers them during the session and the people present will remember his answers.
   A new question is added what happens if a certain product is not available at the moment that the customer tries to order it.
C. Example A is added to Rule 1.
   Question X is registered so that the product owner together with the business analyst of the team can determine how to get the gender of the persons involved.

Question Y is registered so that the product owner together with a database specialist can determine how to store the calories per product.

D. You suggest to add a different example containing people that are elderly (above 70 years of age) because they generally need less calories on a day. This must be added to rule 2.

A. Incorrect
Example A related to rule 1 (not 2).
The question X must be registered for later investigation and the team moves on with the conversation.
The question Y also must be registered because technical information is also relevant to (some of) the team members. (book section 35.2.2)

B. Incorrect
Example A is indeed added to Rule 1 (so this is correct).
The questions must be registered.
The new question does not relate to the feature of counting the calories so this question should be registered with another example map.

C. Correct
The example is registered with the rule and the questions are registered for follow-up. (see book section 35.2.2)

D. Incorrect
This should not be an extra example but an extra rule, or an extension of rule 1. It should not be added to rule 2 because it relates to rule 1.

2.21. LO24 - Test-driven development

In your team at QualityLand your fellow team member Heidi proposes to improve the way unit tests are created by implementing Test Driven Development (TDD). She has taken a training course and remembers that one of the advantages of TDD is that no more code will be written than is necessary. But she forgot how this TDD principle is called.
Which of the TDD principles has this advantage?

A. The TDD principle "Red, Green, Refactor".
B. The TDD principle "Keep It Simple Stupid" (KISS).
C. It's all about collaboration.
D. By combining TDD and Specification and Example approaches the team can generate an effective and balanced set of test scenarios.

A. Correct
Red = write a unit test
Green = write code to make the test pass
Refactor = update the code, while the test still passes
See syllabus 7.3.2
B. Incorrect
This principle will minimize the amount of test cases.
See syllabus 7.3.2
C. Incorrect
This principle does not necessarily limit the code that is written. Instead it ensures that other team members are involved in creating unit-tests and that the unit-tests can be used by anyone in the team.
See syllabus 7.3.2
D. Incorrect
This principle relates to TDD and Specification and Example with regards to the tests produced and not related to minimizing the code written.

2.22. LO25 - Feature toggles

Which of the following is the correct description of an Ops Toggle?

A. This toggle serves to disconnect the feature release and the deployment schedule. It also prevents the use of feature branches and additional merge difficulties.
B. This toggle is used to make specific parts of the application accessible to a specific set of users. These should not be confused with authorization rules, however.
C. This toggle controls turning experimental features on or off. A perfect application for this toggle is to perform a Canary release
or A / B testing .
D. This toggle can be seen as a circuit breaker for non-essential functionalities. Features with a large performance impact can, for example, be switched off dynamically when the application experiences a high load.

A. Incorrect
This is the description of a Release toggle (section 35.8)
B. Incorrect
This is the description of a Permission toggle (section 35.8)
C. Incorrect
This is the description of an Experiment toggle (section 35.8)
D. Correct
This is the description of a Ops toggle (section 35.8)

2.23. LO27 - Test varieties

Frederique is the Product Owner of your QualityLand team and she asks you what your team will use to determine the variety in testing that is needed.
What is your answer to this question?

A. We use quality characteristics to determine the test strategy with enough variety.
B. We use the spheres of testing (such as unit, system and business perspective) to determine the test varieties needed.
C. We use the testing pyramid and the testing quadrants to determine the relevant test varieties.
D. We use the quality characteristics, the spheres of testing, the testing pyramid, the testing quadrants and whenever relevant even other perspectives to determine the test varieties.

A. Incorrect
Quality characteristics are only one of the aspects to determine the test varieties.
B. Incorrect
The spheres of testing are only one of the aspects to determine the test varieties.
C. Incorrect
The testing pyramid and testing quadrants are only a few of the perspectives to determine the test varieties.
D. Correct
See book chapter 37.

2.24. LO28 - Quality characteristic maintainability

Menno, a developer in the IT team of QualityLand, has the following plan to reduce technical debt: All software classes should be composed of discrete (separate and independent) components, so that a change has minimal impact on other components. Which aspect of maintainability is Menno talking about?

A. Analyzability
B. Modifiability
C. Modularity
D. Testability

A. Incorrect. Analyzability is about how well it is possible to assess the impact a software change has.
B. Incorrect. Modifiability is about the degree to which a product can be modified without introducing new bugs.
C. Correct (Book chapter 41.1)
D. Incorrect. Testability is about the degree to which test criteria can be established.

2.25. LO29 - Mutation testing: Test the tests

The new butterfly-ride in QualityLand is only for young children. The selection is based on the age.
Children that are not older than five years get access, other children are not admitted.
Your fellow team member Sigrid has created the following test cases:
TC1: age is 4, child gets access
TC2: age is 5, child gets access
TC3: age is 6, child is not admitted

You apply mutation testing to verify if the test set is complete. What is the result of your mutation testing?

A. Based on mutation testing you determine that TC1 is superfluous, because with TC2 you already cover the equivalence class for children that don't get access.
B. Based on mutation testing you determine that an extra testcase is needed:
TC4: age is 7, child is not admitted
Because if the developer would program "IF age = 6 THEN child-is-not-admitted ENDIF" the fact that children older than 6 would not be detected by the test cases.
C. Based on mutation testing you determine that an extra testcase is needed:
TC4: age is 3, child gets access.
Since you always want two test cases for each side of the boundary, that would be 3 and 4 on one side and 5 and 6 on the other side.
D. Based on mutation testing you determine that there is a fault in the program code and you register an anomaly so that someone with a development role in the team can fix this fault.

A. Incorrect
If the question was to only apply equivalence partitioning this would be correct.
However, with mutation testing you try to find all mutations possible in the code.
B. Correct
This indeed describes a mutation that would not be detected.
See chapter 42 of the book.
C. Incorrect
This reasoning relates to 4-value boundary value analysis. But it is a wrong view. The 4 test cases must be evenly divided over equivalence classes. So with the boundary value 5 not being admitted, 5 and 6 would be in the not admitted class and 3 and 4 in the child gets access class.
D. Incorrect
Mutation testing does not test the test object. Instead mutation testing tests the test, by changing the program code.

2.26. LO30 - Selecting and combining approaches and techniques

You cannot test everything, so you need to select what to test and what not, and you also need to select the intensity of testing. What is the most important factor to make these selections?

A. Acceptance criteria.
B. Equivalence partitioning.
C. The time left in the sprint.
D. Quality risks.

A. Incorrect
Acceptance criteria determine whether the user story is good enough, but are not the most important factor when selecting what to test and what not.
B. Incorrect
This is an example of a test design technique which may be the result of the selection process, but not the factor while making the selection.
C. Incorrect
This is not a good basis to select what to test and what not.
D. Correct
Book chapter 45.6

2.27. LO31 - Process oriented overview

In the process-oriented coverage group we distinguish several test design techniques. Which of the following is a process-oriented test design technique?

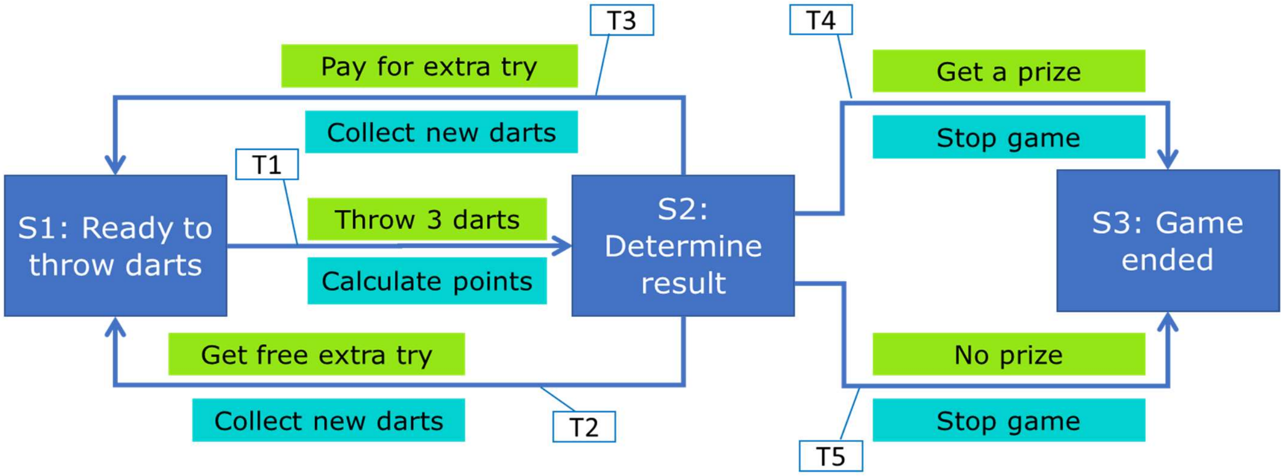
A. Control flow testing
B. Data cycle testing
C. Statement testing
D. Abuse & Misuse cases

A. Incorrect
This is a condition-oriented test design technique.
B. Incorrect
This a test design technique within data-oriented test design
C. Correct
This a process-oriented test design technique. (book chapter 45)
D. Incorrect
This is an appearance-oriented test design technique.

2.28. LO32 - Coverage types & Test Design Techniques - State transition testing

In the QualityLand game zone visitors can play a game of darts. They pay 2 QualityLand coins for a throw of 3 darts. If they throw 140 points or more, they win a prize and the game ends. If they throw 100 or more points (but less than 140) they get a free extra try. If they throw less than 100 points they can pay 1 coin for an extra try, or they can decide to stop playing without getting a prize.

The state transition diagram shows the 3 states and 5 transitions of this case.



How many test situations will you create for 0-switch coverage?
How many test situations will you create for 1-switch coverage?
Which test case(s) give (at least) 100% 1-switch coverage?

A. Number of 0-switch coverage test situations: 5
   Number of 1-switch coverage test situation: 6
   Test cases for 100% 1-switch coverage: S1-T1-S2-T2-S1-T1-S2-T4-S3
   S1-T1-S2-T3-S1-T1-S2-T5-S3

B. Number of 0-switch coverage test situations: 3
   Number of 1-switch coverage test situations: 8
   Test cases for 100% 1-switch coverage:
   S1-T1-S2-T2-S1-T1-S2-T1-S2-T4-S3
   S1-T1-S2-T2-S1-T1-S2-T5-S3

C. Number of 0-switch coverage test situations: 5
   Number of 1-switch coverage test situation: 8 (3 transitions for S1, 5 transitions for S2 and 2 transitions for S3)
   Test cases for 100% 1-switch coverage: S1-T1-S2-T2-S1-T1-S2-T3-S1-T1-S2-T4-S3-S2-T5-S3

D. Number of 0-switch coverage test situations: 3 (every state)
   Number of 1-switch coverage test situations: 5 (every transition)
   Test cases with 100% 1-switch coverage:
   S1-T1-S2
   S2-T2-S1
   S2-T3-S1
   S2-T4-S3
   S2-T5-S3

A. Correct
   0-switch coverage: A test situation for every individual transition. There are 5 transitions, so 5 test situations.
   1-switch coverage: A test situation for every two consecutive transitions. Calculate the number of test situations by multiplying the number of incoming and outgoing transitions per state, and adding the results: 2 + 4 + 0 = 6
   The transition pairs are: T1-T2, T1-T3, T1-T4, T1-T5, T2-T1, T3-T1.
   At least 2 test cases are needed because there are 2 end-points. The test cases shown cover all transition pairs.
B. Incorrect
   3 is the number of states, not the number of transitions.
   8 is the number of states plus the number of transitions, this is not a good way to calculate 1-switch coverage.
   The first test case is impossible (it combines S2-T1-S2 which is a non-existing test situation)
   Also the test cases both don't contain the test situation S2-T3-S1
C. Incorrect
   The number of 0-switch coverage test situations is correct, 5 transitions.
   The calculation of the number of 1-switch coverage test situations is incorrect, see correct answer for explanation.
   The test case is incorrect because you can't continue from S3 to S2 since there is no outgoing transition from S3 (it is an "end-state").
D. Incorrect
   3 test situations can be used for state coverage, that covers every state, but is is not 0-switch coverage.
   5 test situations that cover every individual state gives 0-switch coverage (not 1-switch coverage)
   The test cases shown give 100% 0-switch coverage (not 1-switch coverage)

2.29. LO33 - Coverage types & Test Design Techniques - Code Coverage

You are the agile coach of a QualityLand team. Recently Felix joined the team, right after passing his university information technology exams.
Felix has just produced his first piece of code using TDD, and he very proudly tells you that he has achieved 100% code coverage.
You ask what coverage type of code coverage he refers to. Felix looks puzzled and ashamed because he doesn't know. Then he tells you that the quality risk is of the highest level and asks you what coverage type you would suggest. What is your answer?

A. You answer that line coverage is the coverage type to select.
B. You answer that path coverage is the coverage type to select.
C. You answer that statement coverage will ensure that all of the code is covered which in this case is enough.
D. You answer that 0-switch coverage would not be enough and therefore advise to apply 1-switch coverage.

A. Incorrect
Line coverage is the lowest coverage type which even doesn't test all statements.
B. Correct
When the quality risk is of the highest level you would like to have the highest possible coverage type which indeed is path coverage, especially if used with test depth level 2. (book section 46.8)
C. Incorrect
Although indeed statement coverage ensures that all statements in the code are covered, still there may be decision outcomes that are not covered and there may be path combinations that are not covered.
D. Incorrect
0-switch coverage and 1-switch coverage relate to State Transition Testing. These are not related to code coverage.

2.30. LO34 - Condition-oriented test design overview

In the condition-oriented coverage group we distinguish several test design techniques. Which of the following test design techniques belongs to condition-oriented test design?

A. Path testing
B. Data Combination testing
C. Elementary Comparison testing
D. Abuse & Misuse cases

A. Incorrect
This a process-oriented test design technique.
B. Incorrect
This a data-oriented test design technique.
C. Correct
This a condition-oriented test design technique. (book 45.3)
D. Incorrect
This an appearance-oriented test design technique.

2.31. LO36 - Modified Condition Decision Coverage (MCDC)

Children can do the ball-throwing game in QualityLand. They get 2 balls and try to hit a stack of 6 cans. The rule for winning a prize is:
IF >= 2 cans are hit in the first throw AND > 4 cans are hit in two throws together OR all cans are hit in the first throw by a brother or sister of the child who is playing in another lane at the same time THEN the kid wins a prize.
The test situations are worked out in a table:

R = (A AND B) OR C

	1 (prize)			**0 (no prize)**		
A:	**1**	**1**	**0**	**0**	**1**	**0**
B:	**1**	**1**	**0**	**1**	**0**	**0**
C:	**.**	**.**	**1**	**.**	**.**	**0**

Which answer shows correct possible values for TRUE (1) or FALSE (0) on the open dot's in the last row of the table where condition C should determine the result of the decision point?

A. The possible values are:
C: 1 1 1 1 1 0
B. The possible values are:
C: 0 1 1 1 1 0
C. The possible values are:
C: 0 1 0 0 1 0
D. The possible values are:
C: 0 0 1 1 0 0

A. Incorrect
For the TRUE column you wouldn't know if (A AND B) determines getting the prize or C determines getting the prize. And (even worse) for the FALSE column (A AND B) is true so the result would be TRUE making this test situation incorrect.
B. Incorrect
This is an incorrect example of test situations because in the "no prize" column the values for condition A and B together give a TRUE outcome and thus would the child win a prize which is not intended.
C. Incorrect
This is an incorrect example of test situations because in the "prize" column the values for condition A and B together give a FALSE outcome and thus would the child not win a prize which should be intended.
D. Correct
These are correct examples of TRUE and FALSE values for the sub columns.
0 0 1 in the "Prize" column makes sure that it is condition C that determines that the prize is won.
1 0 0 in the "No prize" column is a good example to make sure that condition C determines that no prize is won (together with the total result of (A AND B) which also must be FALSE to not win a prize.
See book section 46.4 and syllabus section 7.7

2.32. LO37 - Test design techniques - Semantic Test

Children can do the ball-throwing game in QualityLand. They get 2 balls and try to hit a stack of 6 cans. The rule for winning a prize is:
IF >= 2 cans are hit in the first throw AND > 4 cans are hit in two throws together OR all cans are hit in the first throw by a brother or sister of the child who is playing in another lane at the same time THEN the kid wins a prize.

The test situations for this decision point are worked out in a table:

R = (A AND B) OR C

	1 (prize)				**0 (no prize)**			
A:	**1**	**1**	**0**	**D1-1**	**0**	**1**	**0**	**D1-3**
B:	**1**	**1**	**0**		**1**	**0**	**0**	**D1-4**
C:	**.**	**.**	**1**	**D1-2**	**.**	**.**	**0**	

What test case is a correct logical test case for testing test situation D1-1?
(note: D1-2 is not filled in here, but was already part of the exam question for LO36)

A. The child hits 3 cans in the first throw and hits 0 cans in the second throw. The child doesn't win a prize.
B. The child hits 3 cans in the first throw and hits 5 cans in total. The child wins a prize.
C. The brother or sister of the child hits 6 cans in the first throw and the child itself hits less than 4 cans. The child wins a prize. (and the brother or sister also wins a prize!)
D. The child hits 1 can in the first throw and hits 5 cans in the second throw. The child doesn't win a prize.

A. Incorrect
   This is a logical test case for test situation D1-4.
B. Correct
   This is a logical test case for test situation D1-1
   See book section 46.4 and syllabus section 7.7
C. Incorrect
   This is a logical test case for test situation D1-2
   (where for D1-2 the dots should be filled in as seen with the exam question for LO36)
D. Incorrect
   This is a logical test case for test situation D1-3
   (by the way, children may be disappointed that they don't get a prize if they hit all cans in both throws together but didn't have enough in the first throw, but that is how the boss of QualityLand made the rule :-))

2.33. LO38 - Test design techniques - Elementary Comparison Test

Children can do the ball-throwing game in QualityLand. A child can try once and when it wins a price the child can choose to collect the prize or to try again and try to get a bigger prize. The decision process is:
The child gets 2 balls and tries to hit a stack of 6 cans.

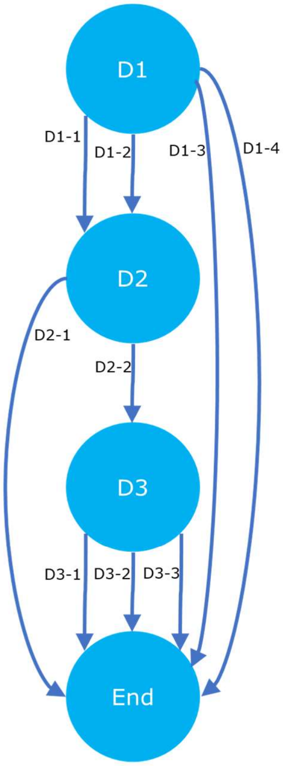
The rule for winning the initial prize is:
IF >= 2 cans are hit in the first throw AND > 4 cans are hit in two throws together OR all cans are hit in the first throw by a brother or sister of the child who is playing in another lane at the same time THEN the kid wins a prize and can decide to take another try ELSE the child leaves.

The rule for deciding on a second try is:
IF the child chooses to try again THEN go to the next step ELSE the child gets the prize and leaves.

The rule for taking the second try is:
If the child hits all 6 cans in one throw OR the child hits at least 5 cans in both throws THEN the child gets a bigger prize ELSE the child gets a normal prize.

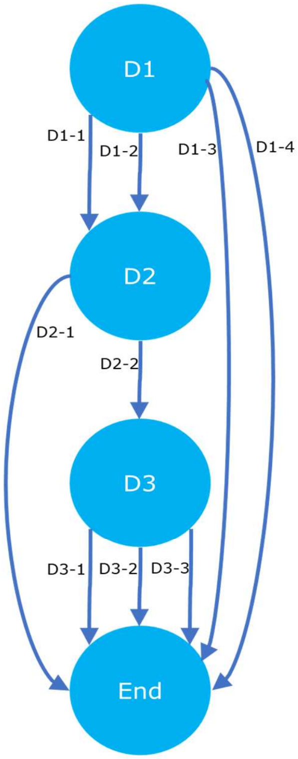
Which of the pictures shown is a correct graph of this process and how many logical test case will be needed as a minimum to test this graph?

Answer A



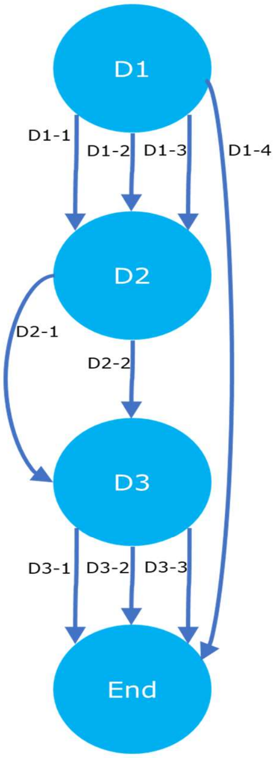
The minimum number of logical test cases is 4.

Answer B



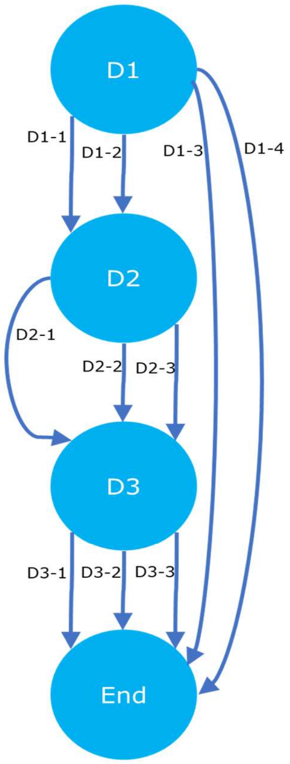
The minimum number of logical test cases is 6.

Answer C



The minimum number of logical test cases is 4.

Answer D



The minimum number of logical test cases is 5.

A. Incorrect
The graph is correct but the minimal number of logical test cases must be 6, as indicated by the highest number of parallel lines.

B. Correct
The graph is correct and the minimal number of logical test cases is 6, as indicated by the highest number of parallel lines.

C. Incorrect
The graph is incorrect, test situations D1-3 and D2-1 end in the wrong decision point.
The minimal number of logical test cases would be correct (if the graph would be correct), that is 4, as indicated by the highest number of parallel lines.

D. Incorrect
The graph is incorrect, test situations D2-1 ends in the wrong decision point and D2-3 shouldn't exist because decision point 2 only has one condition so only 2 test situations (n + 1 test situations).
The minimal number of logical test cases would be correct (if the graph would be correct), that is 5, as indicated by the highest number of parallel lines.

2.34. LO39 - Data-oriented test design overview

In the data-oriented coverage group we distinguish several test design techniques.
Which of the following test design techniques belongs to data-oriented test design?

A. Data Flow testing
B. Semantic testing
C. Syntactic testing
D. Path testing

A. Correct
This a data-oriented test design technique. (book 45.4)

B. Incorrect
This a condition-oriented test design technique.

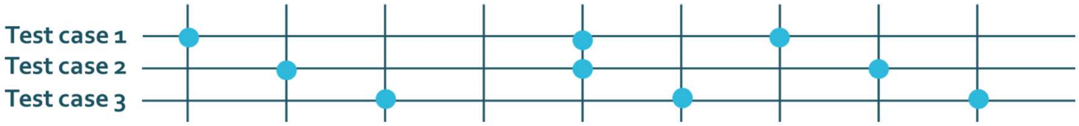
C. Incorrect
This an appearance-oriented test design technique.

D. Incorrect
This a process-oriented test design technique.

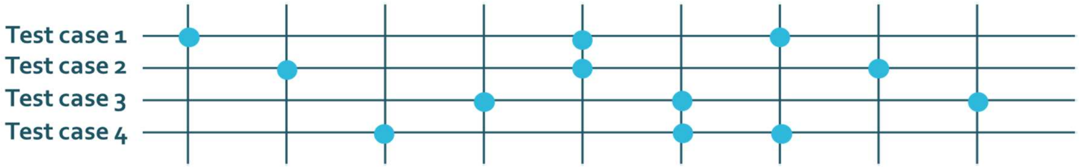
2.35. LO42 - Data Combination Test (including EP, BVA and Pairwise)

A special attraction in QualityLand is that children can dress like their favorite superhero. For this there is an app to select the outfit-items they want to wear. They can select footwear (sneakers, flipflops, high boots or low boots), a mask (full face or covering eyes only) and a hat (cap, beanie or helmet).
There is not too much time and not too much quality risk involved so you have decided that you will test this with the Data Combination Testing technique with the lowest coverage level which is to make test cases to cover at least every possible value of every data item. See the classification tree and decide what must be filled in for Test Case 3, and if there is a need for a Test Case 4 what values would be needed for that Test Case.

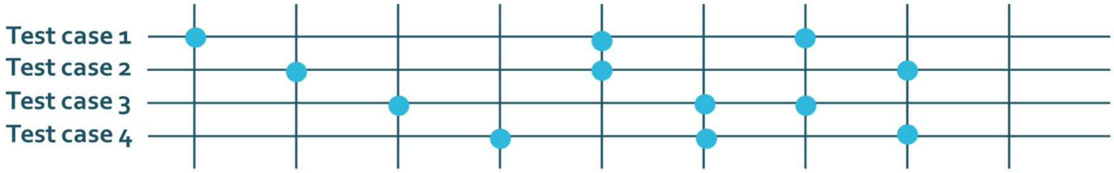
Answer A



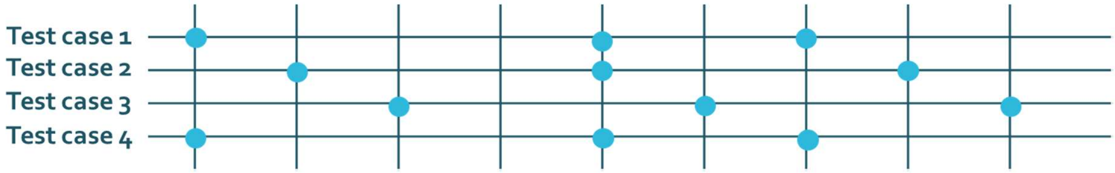
Answer B



Answer C



Answer D



A. Incorrect
Test cases 1 through 3 are correct but the value "low boots" is not covered by any test case and the assignment says "cover at least every possible value of every data item".

B. Correct
All values of all data items are covered.
You may wonder why test case 3 covers low boots and test case 4 covers high boots but this order of coverage doesn't matter.
See book section 46.6

C. Incorrect
The value Helmet is not covered in any test case.

D. Incorrect
The value low boots is not covered and although boots in general are covered you still haven't covered every value of every data item.

2.36. LO44 - Experience based testing checklist

One of your QualityLand team members has created the below checklist for static testing whether data items comply with the data dictionary.
- Restricted choice check (e.g. Mr., Mrs., Miss)
- Presence check (mandatory field)
- Format check (check e.g. date field DD-MM-YYYY)
- Range check (check e.g. age of people 0 - 125 years)

You see this checklist is not complete. Which of the answers shows correct additions to this checklist?

A. - Calculation methods
   - Reports
   - Database functionality

B. - database accessibility,
   - server locations,
   - network diagrams,
   - protocol definition

C. - Coding standards
   - Cyclomatic complexity
   - Ratio of documentation to code

D. - Fields check for min/max length,
   - Fields check for data type,
   - Fields check for list values.

A. Incorrect.
   These are additions to a functional requirements validation checklist.

B. Incorrect, these are additions to a architecture review checklist.

C. Incorrect
   These are additions to a Pull Request checklist.

D. Correct
   These are additions to a fields dictionary validation checklist.

2.37. LO45 - Quality characteristics and non-functional testing

QualityLand is introducing a new attraction for kids. There are little electric boats that can be remotely controlled. The complete system (boats, charging stations, wireless communication system) is supplied by a well-known company that also gives clear evidence that the quality of the system has been thoroughly tested.
The QualityLand Product Owner has asked you to make sure that, after the system is implemented in QualityLand, the kids can safely use it and will be happy to use it.
Which quality characteristics does the Product Owner refer to?

A. Satisfaction and Freedom from risk
B. Maintainability and Intelligent behavior
C. Security and Effectiveness
D. Usability and Reliability

A. Correct
See book A.4 (ISO25010 quality characteristics for quality in use)
B. Incorrect
Maintainability is about product quality, which is a concern of the supplier. Intelligent behavior is related to Artificial Intelligence which is not relevant here.
C. Incorrect
Security is not related to safety. Effectiveness is not related to "happy to use".
See appendix of the book.
D. Incorrect
Usability does not relate to safety and only indirectly to happiness. Reliability does not relate to safety and not to happiness.
See appendix of the book.

2.38. LO47 - Static Code Analysis with Sonarqube

Different code guidelines are used within the QualityLand development teams. The teams have defined coding guidelines that all teams need to use. What do you recommend to automatically check if code complies to these guidelines?

A. Install a tool such as SonareQube, add the code guidelines and use this static code analysis in the Continuous Integration pipeline
B. Make one team responsible for checking every code commit based on the new guidelines using a peer-review.
C. Create unit tests that verify if the code is up to standards.
D. Create an acceptance test that verifies if the code is up to standards.

A. Correct.
“Recommendations on code formatting. Static analyzers allow you to check if the source code corresponds to the code formatting standard used in your company.”
B. Incorrect.
This is not automation but manual checking.
C. Incorrect.
Unit test don’t inspect code but test the behavior of the program.
D. Incorrect.
Acceptance tests don’t inspect code.

2.39. LO48 - Clean architecture

What is an example of code that follows the principles of clean architecture?

A. Code that can easily be changed without having to change the interface and where separate functions are separate pieces of code.
B. Code that is as short as possible where data is exchanged in dedicated variables within the code that may be changed if the code changes. Also the functions are programmed such that as much code as possible is reused.
C. Code that is programmed in a 3d generation language follows principles of clean architecture. 4th generation programming languages usually result in much more machine-level code and thus in slower response times.
D. Clean architecture means that all user stories are specified from an end-user perspective and follow the business processes. Also a project start architecture (PSA) is important for this.

A. Correct
This describes loosely coupled (change without changing the interface) and high cohesion (separate functions have separate pieces of code)
See syllabus section 7.2
B. Incorrect
If data is exchanged in dedicated variables this is tightly coupled. If code is used for multiple purposes this is low cohesion.
C. Incorrect
Clean architecture doesn't have any connection to the generation of programming language or the performance of the resulting system. Instead it is connected to maintainability.
D. Incorrect
Clean architecture as mentioned in this certification relates to program code, not to high-level architecture such as a project start architecture. (see syllabus section 7.2)

2.40. LO49 - Unit testing principles

You are one of the QualityLand IT delivery team members with a development role. The product owner asks you what kind of code units have a high cost/benefit relation, which means that the costs for testing are relatively low but the benefits are relatively high. Which is the correct answer?

A. Testing of complex code with many dependencies. Since it is complex and dependent the benefits of unit testing are high and that justifies the high costs.
B. Testing of trivial code with many dependencies. Since it is trivial and dependent the benefits of unit testing are low and that does not justify the high costs of unit testing so it is better to don't do unit testing for this category.
C. Testing of complex code with few dependencies. Since it is complex but not dependent the benefits of unit testing are high and given the low costs this is an ideal combination.
D. Testing of trivial code with few dependencies. Since it is trivial and has few dependencies the benefits of unit testing are low but since the costs of unit testing are also low, just do unit testing for this category.

A. Incorrect
Complex code with many dependencies has both high costs and high benefits, which is not the best combination. (Syllabus 7.5.2)
B. Incorrect
Trivial code with many dependencies has high costs and low benefits, so it is indeed better not to do unit testing (but integration testing instead). (Syllabus 7.5.2)
C. Correct
Complex code with few dependencies has low costs and high benefits, which is the best combination. (Syllabus 7.5.2)
D. Incorrect
Trivial code with few dependencies is a category that just should be unit tested without too much thought about it. But this has not the best cost/benefit ratio as the product owner asked. (Syllabus 7.5.2)

You can contact the Sogeti Academy in the Netherlands at academy.nl@sogeti.nl.

You can contact iSQI about the TMAP exams at: TMAP2020@iSQI.org

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