Faculty of Information and Communication Technology		
Tshwane University of Technology — *We empower people*	**MODULE NAME:** Software Engineering Fundamentals **MODULE CODE:** SEF216D	
I declare that I am familiar with, and will abide to the Examination rules of Tshwane University of Technology _____ **Signature**	Formative assessment **Duration**: 2 Hours **Date**: 20 November 2021 **Total Marks**: 55 **Total pages**: 15	**Examiners**: RT Hans **Moderator**: Mr TR Phihlela
	Student number	
	Surname:	**Initials**: /55 %

INSTRUCTIONS: Answer ALL questions. Use the spaces provided to answer each question.

Question 1   [11]

For Questions 1.1 to 1.4, state whether the statements are **True** or **False**:

1.1   A critical path is the shortest path in the PERT/CPM chart, but yet it is the longest time to complete the project.   (1)

False_____

1.2   During software crisis era, project managers performed poorly.   (1)

False_____

1.3   Software quality is a non-functional attribute of software.   (1)
True_____

1.4   Figure 1 below represents a typical software incremental development approach.   (1)
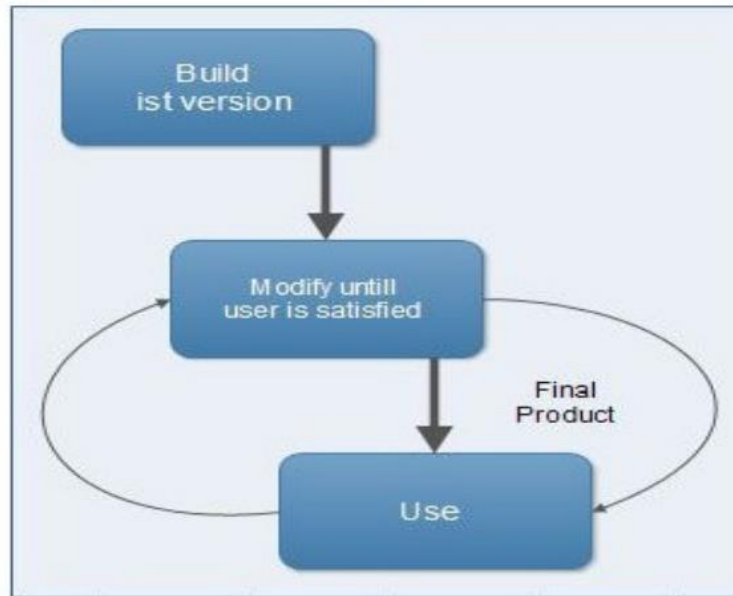False_____

Figure 1

For Questions 1.5 to 1.10, **select the correct answer from the given answers. Just write down the correct corresponding letter of the answer, for example: (a)**

1.5   With *Waterfal model* :   (1)

   a)   Customers are able to use and gain value (return on investment (ROI)) from the software earlier.
   b)   Risk of overall project failure is much lower.
   c)   If no careful attention is paid this development may degenerate into build-and-fix.
   d)   Disciplined development approach is enforced.
   e)   User interaction is encouraged/promoted.

Answer: (d)_____

1.6   A software engineer *is not obligated* by ACM/IEEE code of ethics to   (1)

   (a)   act consistently with the public interest.

   (b)   belong to a professional body such as ACM or IEEE.

   (c)   act in a manner that is in the best interests of the client.

   (d)   act in a manner that is in the best interests of the employer.

   (e)   independence in their professional judgment.

Answer: (b)_____

1.7   When creating a work breakdown structure (WBS), it is *not important* to   (1)

   (a)   specify the resources to be used in completing the tasks.

   (b)   list all tasks.

   (c)   decide how long each task takes.

   (d)   add a description for each task.

Answer: (a)_____

1.8   Unified Modeling Language (UML) *consists of the following models*:   (2)

   (a)   Behavioral models, structural models and interaction models

   (b)   Behavioral models, structural models business process model and interaction models

   (c)   Behavioral models and structural models

   (d)   Behavioral models and interaction models

   (e)   Behavioral models, structural models, interaction models and software development models

   Answer: (a)_____

1.9   The following are examples of functional requirements   (1)

   a)   The Brightspace (D2L) system should notify students of their marks grades.

   b)   The D2L system should keep students marks confidential.

   c)   The D2L system should send announcements to students via TUT email addresses.

   d)   All of the above

   e)   (a) and (c)

   f)   (b) and (c)

   g)   (a) and (b)

   Answer: (e)_____

1.10   The following are valid examples of use cases regarding Brightspace (D2L) at TUT   (1)

   a)   A student uploading an assignment on D2L.

   b)   A student updating his/marks on D2L).

   c)   A lecturer communicating with students through an announcement on D2L.

   d)   All of the above

   e)   (a) and (b)

   f)   (b) and (c)

   g)   (a) and (c)

   Answer: (g)_____

Question 2 [7]

Read the following case study and the answer the questions below that are based on it.

Volkswagen Company's Emissions Scandal: Ethical Dilemma

The ethical dilemma that Volkswagen experienced was necessitated by claims that the automobile maker had cheated on the air pollution tests subjected by the United States. The company had intended to sell diesel cars in the United States. Interestingly, because they were aware of the emission regulations used in America, Volkswagen launched a marketing campaign where they presented their cars as having low emission levels (Hotten par.3). However, the American authorities had to test the cars first before being allowed into the market. The vehicles that the company sold in the American market between 2008 and 2015 did not meet the emissions standards that the American government had set. Volkswagen had installed the cars using for the emission test with special software that altered its emissions (Ewing 40). The software played a crucial role in convincing the authorities that the cars were not emitting harmful gases into the atmosphere beyond unmanageable levels.

Source: https://studycorgi.com/volkswagen-companys-emissions-scandal-ethical-dilemma/

2.1 **Outline how** were the following two (2) *ACM/IEEE code of ethics principles* violated by the software engineers in the above case study.

(a) **CLIENT AND EMPLOYER** - Software engineers shall act in a manner that is in the best interests of their client and employer consistent with the public interest. (2)

The decision by software engineers to participate in the development of a software that altered emission of harmful gases did not only betray the clients and the public trust in them in acting in their best interest, but also put the clients and the public's health at huge risk✓. Furthermore, their act shows that the software engineers put their employer's as well as their interests above those of the clients and the public, thus not acting consistent with the abovementioned principle. ✓

(b) **JUDGMENT -** Software engineers shall maintain integrity and independence in their professional judgment. (2)

Their decision to side with the decision of their superiors and develop a 'cheating systems' indicates that they lacked and did not maintain integrity✓. Moreover, by allowing themselves to be swayed to develop a system that would behave unethically demonstrates that they did not act independently in their professional decision and judgement. ✓

2.2 Explain why software engineering is important. (1)

Software engineering provides software engineers with a much *needed disciplined and systematic approach for designing, developing and managing software. The approach enables the software industry to deal with challenges related to schedules, costs and quality.* ✓

2.3 Describe *any two* benefits that are presented by the use of a rapid prototype model. (2)
   (a) *Any two* of the following:
   - *Promotes user interaction.*
   - *The prototype helps with requirements elicitation and validation.*
   - *Helps determine client(s) real needs.*
   - *Assists in drawing a more accurate specification document.*
   - *Reduces the need to repair process of the system as the user already experimented with the system prior its implementation. That is, improves maintainability.*
   - *Improves system usability.*
   - *Improves design quality.*
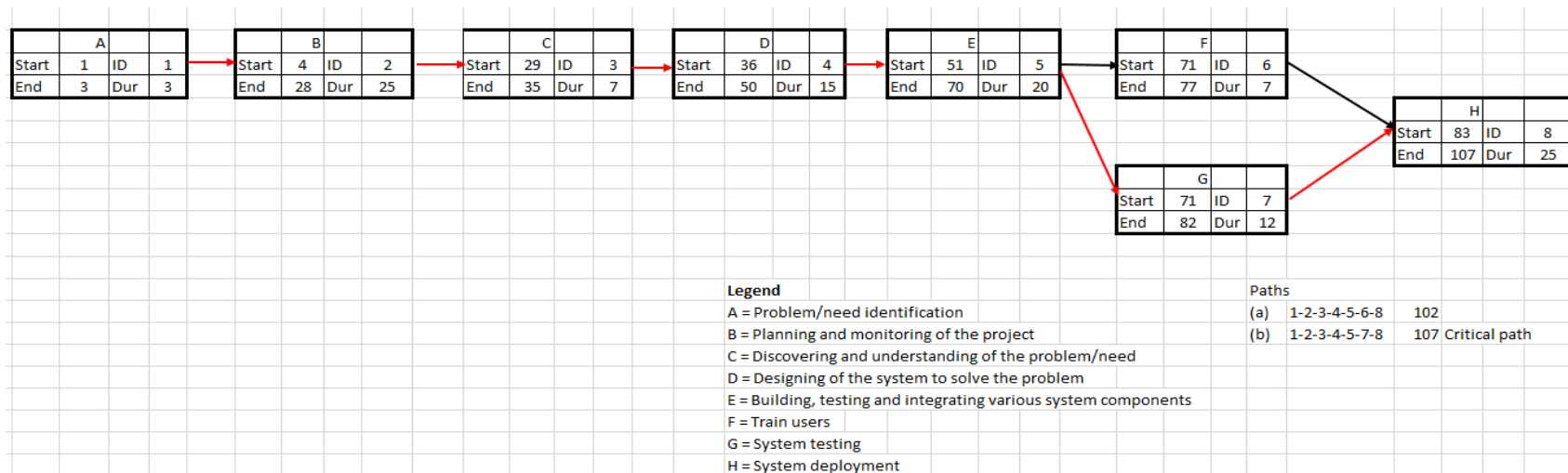   - *Reduces development effort.*

Question 3   [9]

(a)   Consider the following table

Task No.	Task description	Duration (Days)	Predecessor tasks
1	Problem/need identification (A)	3	-
2	Planning and monitoring of the project (B)	25	1
3	Discovering and understanding of the problem/need (C)	7	2
4	Designing of the system to solve the problem (D)	15	3
5	Building, testing and integrating various system components (E)	20	4
6	Train users (F)	7	5
7	System testing (G)	12	5
8	System deployment (H)	5	6, 7

(b)   *Draw a* PERT/CPM of tasks indicated in the table above. ***On the PERT/CPM chart show the critical path****.*   (5)

	A		
Start	1	ID	1
End	3	Dur	3

	B		
Start	4	ID	2
End	28	Dur	25

	C		
Start	29	ID	3
End	35	Dur	7

	D		
Start	36	ID	4
End	50	Dur	15

	E		
Start	51	ID	5
End	70	Dur	20

	F		
Start	71	ID	6
End	77	Dur	7

	H		
Start	83	ID	8
End	107	Dur	25

	G		
Start	71	ID	7
End	82	Dur	12

Legend
A = Problem/need identification
B = Planning and monitoring of the project
C = Discovering and understanding of the problem/need
D = Designing of the system to solve the problem
E = Building, testing and integrating various system components
F = Train users
G = System testing
H = System deployment

Paths
(a)   1-2-3-4-5-6-8   102
(b)   1-2-3-4-5-7-8   107 Critical path

½ a mark for each correct correct task box. One (1) mark for correctly showing the critical path.

(b) *Write down the paths* that you can identify in the PERT/CPM chart drawn in (a) above. (2)

They are: 1-2-3-4-5-6-8 or A-B-C-D-E-F-H ✓and 1-2-3-4-5-7-8 or A-B-C-D-E-G-H ✓

(c) *Name* and *calculate* the length of the critical path of the PERT/CPM chart drawn in (a). (2)

The critical path is: 1-2-3-4-5-7-8 or A-B-C-D-E-G-H ✓ and is 107 days long ✓

Question 4 **[7]**

**4.1** Describe the Unified Modeling Language (UML). (2)

UML is a standard description and specification language for object-oriented (O-O) software used by people who analyse and design O-O systems in order to: ✓
- *visualise, construct and document the artefacts of software systems*
- *and to model the business organizations that use such systems*

✓

4.2 When a student is accepted (admitted) at Seshego university of Technology (SUT), there are a number of processes that are to be followed to ensure the student is admitted properly. The admission process commences immediately after a student's application has been successful. In order for a student to be accepted properly the following tasks are some of the tasks that must be carried out, assigning a student number to the prospective student; assign the prospective student to a course, which is one of applicant's choices; determine whether the student qualifies for university accommodation; Send acceptance letter to the applicant.

(a) Create a FDD for *student acceptance* at SUT by completing the one below. ***Only show two levels*** of the FDD. Note that the FDD you are to create should only concern student acceptance and not student application. (5)

Student acceptance✓

Assign a student number✓

Assign to course✓

Send admission letter✓

Determine if student qualifies for university accommodation✓
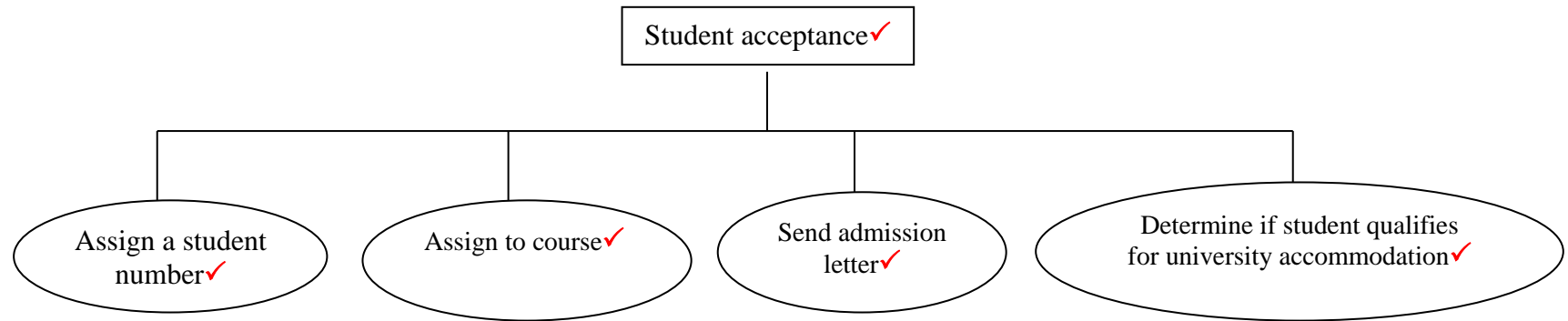
Question 5 [6]

A local bookshop manager approaches you to develop a book recommender system for their clients. The system needs to:
- recommend books to a client based on his recent books purchased from the bookshop.
- notify clients about books that are coming soon that are in line with the client's 'taste'.
- notify clients of the best-selling books, which are in line with a client's preferred books.
- have a good response time.
- be portable and be easily adaptable to new hardware.
- be able to run on various operating systems.
- provide the manager with monthly reports of recommended books for each client.
- enable the manager to draw a sales report on recommended books for each client.

5.1   There are two types of software requirements, name them. (2)

Functional ✓ and non-functional requirements✓

5.2   For each of the two the software requirements types that you named in 6.1, provide an example of each from the bookshop case study given above. **Note**: *give only one of each. If you give more than one for each type, then the first one will be considered when marking.* (2)

*Example of functional requirements (**any one of the following**):*

- Recommend books to a client.
- Notify clients about books that are coming soon.
- Notify clients of the best-selling books.
- Provide the manager with monthly reports of recommended books for each client.
- Enable the manager to draw a sales report on recommended books for each client.

*Example of non-functional requirements (**any one of the following**):*

- Have a good response time.
- Be portable and be easily adaptable to new hardware.
- Be able to run on various operating systems.

5.3 One of the characteristics of good software requirements is the absence of ambiguity. Would you consider the booshop software requirements that you stated in 5.2 to be good or bad? Sustantiate your answer. (2)

*The functional requirements seem to well defined and have no ambiguity. However, one non-functional requirement is ambigous. The requirement that the system should have a good response time is not clear – what is a **good** response time?*

<u>Question 6</u> **[15]**

A local bookshop manager approaches you to develop a book recommender system for their clients. The system needs to:

- recommend books to a client based on his recent book purchases from the bookshop.
- notify clients about books that are coming soon that are in line with the client's 'taste'.
- notify clients of the best-selling books, which are in line with a client's preferred books.
- have a good response time.
- be portable and be easily adaptable to new hardware.
- be able to run on various operating systems.
- provide the manager with monthly reports of recommended books for each client.
- enable the manager to draw a sales report on recommended books for each client.

6.1   Identify one of the actors from the bookshop case study above.   (1)

The bookshop manager

6.2   (a) For the actor you have identified in (a) above, apply user goal technique and write user
            story(ies).   (2)

As a *bookshop manager*, I want to be able to *draw a sales report* pertaining to books that have been recommended to a client so that I *can know whether the system does provide value for money*.

As a *bookshop manager*, I want to be able to *draw monthly reports* pertaining to recommended books to clients so that I *can know the average of recommended books per month in a 6 months cycle*.

        (b) Analyse the user story(ies) in (a) and write down use case(s).   (2)

- Draw a sales report of recommended books
- Draw monthly reports of recommended books

(c) Create a *use case diagram* of the use cases identified in (b) above. (4)

Book recommender system

Draw a sales report of recommended books

Bookshop manager

Book recommender system

Draw monthly reports of recommended books

Bookshop manager
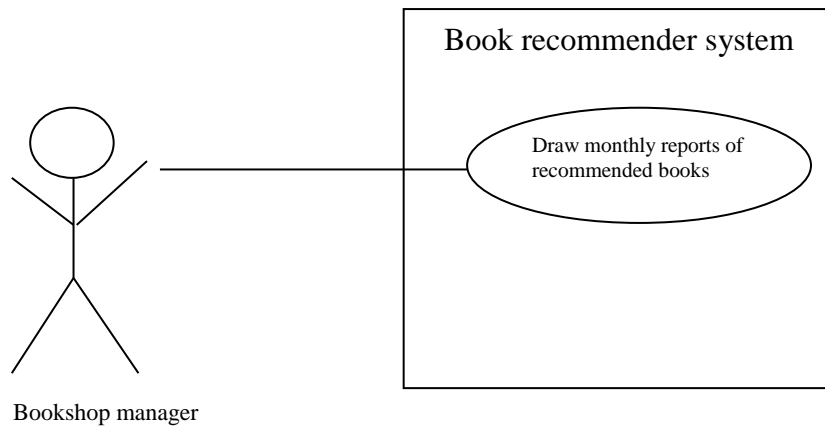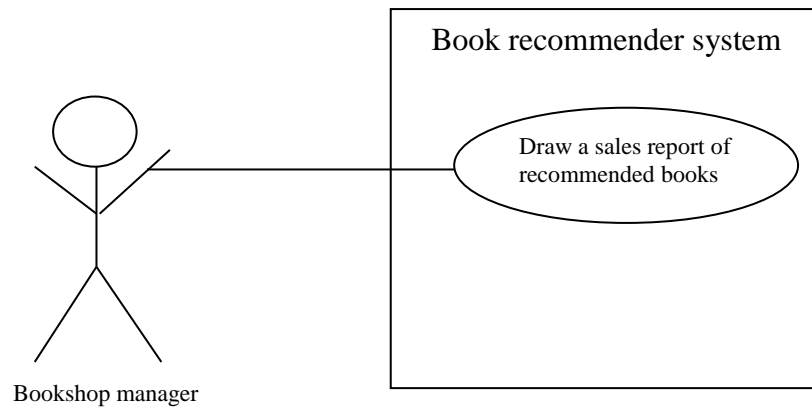
6.3   Consider the following diagram which shows steps followed in creating an announcement by a lecturer on D2L. Design an activity diagram for the announcement use case for a lecturer.   (6)

Lecturer | **D2L Announcement Sub-system**

- Choose required module
- Display menu page (screen)
- Select new announcement menu item from the drop down
- Dislay new announcements form
- Complete new announcement form
- Publish announcement