CLO 1: Explain different views of quality

6

Q1 ..... [1x10 = 10]

Indicate which (**ONE**) of the 11 quality factors of the McCall's model best fits each of the following requirements extracted from the SRS document of a home security system called SecureHome.

#	Requirement	Quality Factor
1	All software modules of SecureHome shall have less than 25 programming language statements.	Efficiency X maintainability
2	SecureHome shall be able to process all data generated by SecureCar (a car security system).	Interperability
3	A home owner shall be able to program SecureHome for detecting intrusions within 10 minutes.	Usability
4	SecureHome shall be able to detect poisonous gases other than CO by simply modifying the configuration file.	Flexibility
5	A fully charged intrusion detection sensor shall transmit data to the central unit of SecureHome for at least 2 weeks.	Reliability & efficiency
6	SecureHome shall not fail more than once in a year.	~~Correctness~~ reliability
7	The reaction time of the firmware installed on the equipment housing an intrusion detection sensor shall be less than 10 microseconds.	~~Flexibility~~ correctness
8	The mobile app of SecureHome shall be able to run on both Android and iOS.	Portability
9	Automatic diagnostics shall be performed to check the health of each sensor whenever SecureHome is restarted.	Testability
10	Only administrators shall be able to arm and disarm SecureHome.	Integrity

CLO 1: Explain different views of quality

Q2 [1x20 = 20]

Fill in the blanks with appropriate technical **words** or **phrases**. Answers must be clear. Cutting and over-writing may lead to disqualification of answer.

1. The origin of software failures lies in a _____ made by a software engineer.
2. A _____ becomes a software failure only when it is "activated".
3. Unlike the objective of software quality assurance, the main objective of _____ is the withholding of any software product that does not qualify for shipment.
4. _____ maintenance deals with fixing defects.
5. _____ factors deal with the adaptation of software to other environments and its interaction with other software systems.
6. Both alternative models (i.e. Evans & Marciniak factor model and Deutsch & Willis factor model) exclude only one of McCall's factors, namely the _____ factor.
7. Significant similarity exists between the _____ factor suggested by the Deutsch & Willis model and the reliability factor described in the MCall's model.
8. Staff training and staff certification are part of the _____ category of components of the comprehensive SQA system.
9. Unlike procedures, _____ provide detailed directions for the use of methods that are applied in unique instances and employed by specialized teams.
10. It is believed that **up to a certain level**, expanding the resources allocated to QA activities yields much larger savings in failure costs while reducing _____ costs.
11. IEEE 1012 standard is an example of a _____ standard
12. The _____ devotes itself fulltime to SQA matters.
13. Prototyping is a software development methodology that has been found to be efficient and effective mainly for _____ sized software.
14. As compared to the original Spiral process, the _____ Spiral process places extra emphasis on risk analysis and resolution.
15. _____ is the process used to determine whether a system or component is suitable for operational use.
16. _____ represents the customer's interest by examining the extent to which the customer's original requirements have been fulfilled.
17. Utilization of a quantitative SQA defect removal effectiveness and cost model enables _____ of different SQA plans.
18. The SQA defect removal effectiveness and cost model studied in this course assumes that various SQA activities (e.g. inspections, unit testing, etc.) serve as _____, removing a percentage of the entering defects and allowing the rest to pass to the next SQA activity.
19. Examination of customer's capacity to meet his commitments is one of the _____ review objectives.
20. The loose relationships maintained between the internal customer and the internal developer increase the probability of project _____

National University of Computer and Emerging Sciences, Lahore Campus

Course Name:	Software Quality Engineering	Course Code:	SE 3002
Degree Program:	BS (SE)	Semester:	Fall 2023
Exam Duration:	60 Minutes	Total Marks:	45
Paper Date:	02-Oct-2023	Weight	15%
Section:	ALL	Page(s):	5
Exam Type:	Midterm-I		

Student : Name: Solution Roll No. _____ Section: _____

Instruction/Notes: 1. Attempt all questions on the question paper. Do not submit any extra sheet, it will not be graded.
2. You are allowed to use a single-sided, hand-written, A-4 size help sheet. Colored or black & white photocopies are not allowed.
3. State your assumptions clearly

Question 1 (Max. Marks = 6+4 =10)

Your company is developing an online banking system. The system should allow customers to perform a variety of tasks such as viewing their account balance, transferring funds, paying bills, and viewing transaction history. The system should provide services 24/7, be able to handle high traffic during peak times, and ensure high security to protect customers' sensitive information.

a. Explain the 3 most relevant Quality Attributes/Characteristics in context of the given requirements for this system. Justify your choices

- Security
  * mentioned in the last sentence. This is a banking app and data protection is considered very important in such apps
- Reliability
  * in order to provide 24/7 services the system should have high MTBF value.
- Performance
  * the system shall handle high traffic

any 3

- Availability : 24/7 services are required.

b. Design 4 black box test cases for the banking system using the appropriate test case structure and input values.

- Appropriate test case structure. (Test Design & unfilled I/O, Result columns)
- Relevant test cases

0024

Question 2 (Max. Marks = 5)

During development of a software product our company conducts inspections and reviews to discover defects at different stages of development. An inspection I_0 of requirements artifacts of product p' discovered 160 defects which were removed immediately before the start of design phase. Another inspection I_1 later captured 400 defects out of which 40 were due to requirements artifacts. Calculate **defect removal effectiveness** of requirements phase only.

Defects removed during requirements = 160

Requirements related defects found later = 40

$$DRE = \frac{160}{40+160} = \frac{160}{200} = 80\%$$

Question 3 (Max. Marks = 5)

Consider the software maintenance related metric fix response time metric Mean Time to Problem Closure (MTPC). Suppose a company has a system in place and the following data is taken from the bug reporting and management system:

Sr.	Reported Problem	Problem open time	Problem closing time	Time taken
1	Problem X	2023-05-10 9:40 AM	2023-05-10 4:40 PM	7 hours
2	Problem Y	2023-05-11 12:40 PM	2023-05-12 2:10 PM	6 hrs 30 min
3	Problem Z	2023-05-11 10:30 AM	2023-05-11 2:30 PM	4 hrs
4	Problem A	2023-05-11 11:00 AM	2023-05-11 4:00 PM	5 hrs

Assume that one day is 8 hours long (9 AM to 5 PM) and only the working hours are counted when calculating the values for MTPC.

a. Calculate the MTPC for the above data.

$\frac{7+6.5+4+5}{4} = \frac{25.5}{4} \simeq$ ~~6.5 hrs~~ 6.37 hrs $\simeq$ 6 hrs 22 minutes 20 seconds

~~6 hrs 37 minutes~~

b. Comment if the fix response time of the company is good or bad. Also give reasons.

Depends on the SLA, if the ~~req~~ prescribed ~~MTTR~~ value is 8 hrs then it's good

if " " " 4 hrs " " bad

0024

Question 4 (Max. Marks = 5)

A company has recently shipped Release$_i$ of a software product p. In Release$_i$, 18000 New Code Instructions (NCI) have been added. During development of Release$_i$ no existing SSI have been deleted however 4000 existing lines have been modified. During the testing of Release$_i$, 2000 errors were discovered in the newly added and recently modified code. Determine **defect density** for the newly added and modified code **only**. Use and mention appropriate units.

Note: SSI = Shipped Source Instructions and is defined as follows:
$SSI_i = SSI_{i-1} + NCI_i$ – deleted code in release$_i$

NCI = 18000 LOC
Modified code = 4000 LOC
Errors = 2000

Size of the release for which the density is to be calculated
= 18000 + 4000
= 22000 LOC (SI)

Defect Density = $\frac{2000}{22000}$ = 1/11 defects per LOC or SI = 0.0909 defects per SI
= 90.9 ≈ 91 defects per KLOC or KSI

Question 5 (Max. Marks = 6+4 = 10)

Consider the project data available in the following project table. The project started on Day 1 and had only 5 tasks, pd stands for person days:

Task	Planned Completion Day	Actual Completion Day	Estimated Effort	Actual Effort Expended
Task 1	Day 2	Day 2	2 pd	3 pd
Task 2	Day 3	Day 4	2 pd	5 pd
Task 3	Day 4	Day 4	1 pd	3 pd
Task 4	Day 4	Day 6	3 pd	6 pd
Task 5	Day 5	Day 7	4 pd	7 pd
			12 pd	24 pd Total

a. Calculate the following metrics for the above project data (the 5 tasks were expected to get completed on day 5 but actually got completed on day 7), show all steps.

i. $Schedule\ Estimation\ Accuracy\ (SEA) = \frac{Actual\ total\ project\ duration}{Estimated\ total\ project\ duration}$ → 7 days → 5 days

$SEA = \frac{7}{5} = 1.4$ (ie. underestimated)

ii. $Effort\ Estimation\ Accuracy\ (EEA) = \frac{Actual\ total\ project\ effort}{Estimated\ total\ project\ effort}$ → 24 pd → 12 pd

$$EEA = \frac{24}{12} = 2$$

b. Keeping in mind the estimation accuracies of part a, provide the planned completion day for task 6 given that its originally estimated effort is 2 pd, it can start after completion of task 5 only and it has only one human resource working on it.

original estimated effort = 2 pd.

original planned completion day = Day 7.

Adjusted estimate of effort based on EEA:

= original estimated effort × EEA

= 2 × 2 = 4 pd.

Adjusted planned completion day

= 7 × 1.4

~ Day 9.

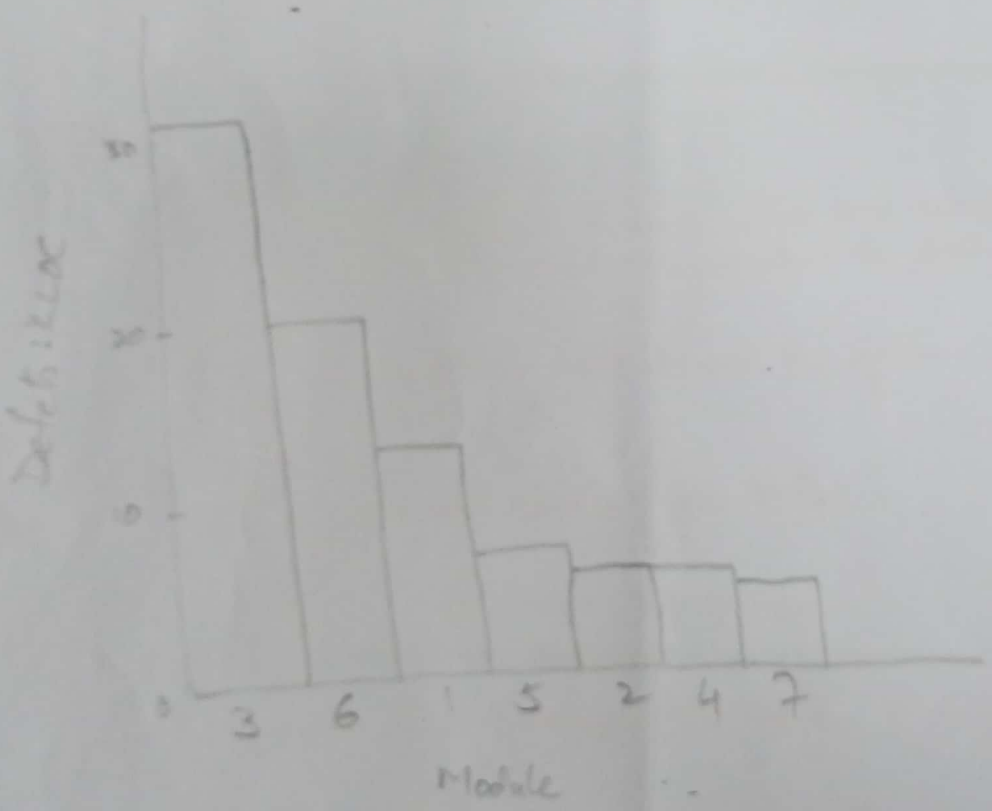
Question 6 (Max. Marks = 7+3 = 10)

Consider the following table about a software project:

Module	LOC: PH	LOC: IH	LOC: TH	Defects: TH	Defects: KLOC	PH: IH
1	160	170	85	1.5	13	1.5
2	145	345	105	0.5	5	2.5
3	105	50	35	1	31	2.5
4	765	790	390	2	5	1
5	100	150	60	0.5	6.5	1.5
6	195	255	110	2.5	19.5	1.5
7	550	525	270	1.5	4.5	1

LOC: Lines of Code, PH: preparation hours, IH: inspection hours, TH: total hours

Consider the above table and draw Pareto diagram for the column (Defects:KLOC) to know the modules that cause the higher number of defects. Label the chart completely. Comment which three modules need more attention to reduce the defect density.



Modules 3, 6, 1 need more attention

National University of Computer and Emerging Sciences, Lahore Campus

0100

Course Name:	Software Quality Engineering	Course Code:	SE 3002
Degree Program:	BS (SE)	Semester:	Fall 2023
Exam Duration:	60 Minutes	Total Marks:	60
Paper Date:	11.11.2023	Weight	15%
Section:	All	Page(s):	6
Exam Type:	Midterm-II		

Student : Name: Solution Roll No. _____ Section: _____

Instruction/ Notes:
1. Attempt all questions on the question paper. Do not submit any extra sheet, it will not be graded.
2. You are allowed to use a single-sided, hand-written, A-4 size help sheet. Colored or black & white photocopies are not allowed.
3. State your assumptions clearly

Question 1 (Max. Marks = 10+10 = 20) CLO 4

An online financial aid processing application of a private university determines the tuition waiver given to a student by looking at the income class of the student's family (H = High, A = Average, L = Low), the gender of the student (M = Male, F = Female), and the CGPA of the student (0.0 – 2.0, 2.1 – 3.0, 3.1 – 4.0). The tuition waiver calculation module of this application uses the tuition waiver percentages shown in the table below.

Income Class		H		A		L	
Gender		M	F	M	F	M	F
CGPA	*0.0 – 2.0*	0	10	10	20	20	30
	2.1 – 3.0	10	20	20	30	30	40
	3.1 – 4.0	20	30	30	40	40	50

A. Fill out the following table with information about equivalence classes (ECs) for the tuition waiver calculation module.

Variable	Valid ECs	Representing values		Invalid ECs	Representing values for invalid ECs
		For valid ECs	On Boundary values		
Income Class	i) High ii) Avg. iii) Low	i) H ii) A iii) L	– – –	Any other value	X, 1, $
Gender	i) Male ii) Female	i) M ii) F	– – –	Any other value	A, J, K, 9, &
CGPA	0.0 ≤ CGPA ≤ 2.0 i) CGPA between 0 & 2 ii) 2.1 ≤ CGPA ≤ 3.0 iii) 3.1 < CGPA ≤ 4.0	1.5 2.4 3.7	0.0 & 2.0 2.1 & 3.0 3.1 & 4.0	i) CGPA < 0.0 ii) 4.0 < CGPA	-0.9 -4.2

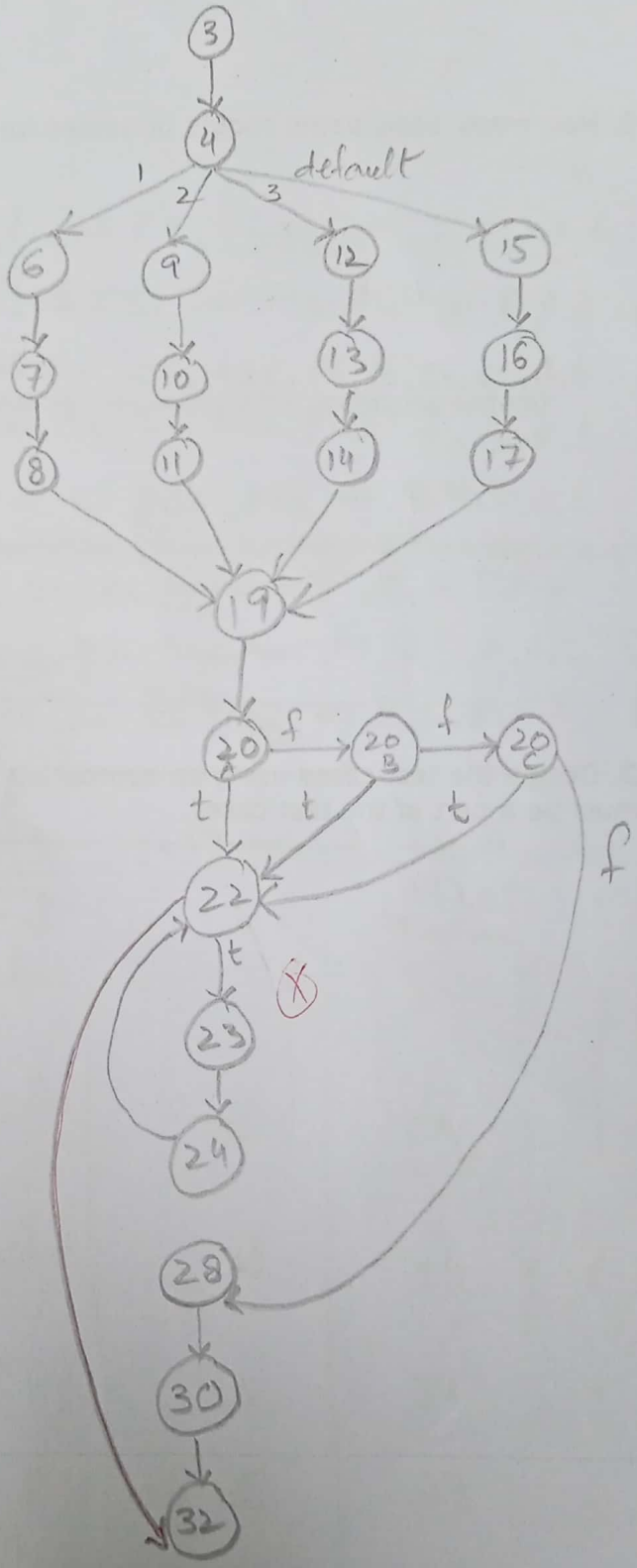
B. Fill out the following table with information about test cases for the tuition waiver calculation mo
Equivalence Class Testing and design **minimum** test cases in the following table. Add more rows if required.

Test case type	Test case no.	Income Class	Gender	CGPA	Expected Output (Waiver percentage)
For valid ECs	1	H	M	1.5	0
	2	A	F	2.4	30
	3	L	M	3.7	40
For invalid ECs	4	X	M	1.5	
	5	A	J	3.7	
	6	H	M	-0.9	
	7	L	F	4.2	

Question 2 (Max. Marks = 5 + 5 + 5 + 5 = 20) CLO 4 0100

A. Draw the control flow graph (CFG) of **foo** given below. Draw the CFG in the space available besides the box with the code. Decision Nodes must be annotated clearly. [Note: Line numbers have been added at the start of each line of code for convenience, use these numbers only]

```
1 int foo (int a)
2 {
3   int b=0;
4   switch(a)
5   {
6     case 1:
7       b=a;
8       break;
9     case 2:
10      b=(a/2);
11      break;
12    case 3:
13      b=(a/3);
14      break;
15    default:
16      b=0;
17      break;
18  }
19  int c = 0;
20  if (b==a || b==0 || a==0)
21  {
22    while (c != 10)
23    {
24      a+=c;
25      c++;
26    }
27  }
28  else
29  {
30    c=(b+10);
31  }
32  return (a+b+c);
33 }
```



N=24 , E=30

B. Find cyclomatic complexity for the CFG of **foo**? Show complete working.

CC : E - N + 2

= 30 - 24 + 2

= 8

C. How many basis paths should be tested for **foo**? List all the basis paths for the CFG drawn in part A.

8

P1: 3, 4, 6, 7, 8, 19, 20A, 22, 23, 24, 25, 26, 22, 32

P2: 3, 4, 9, 10, 11, 19, 20A, 22, 23, 24, 25,26, 22, 32

P3: 3, 4, 12, 13, 14, 19, 20A, 22, 23, 24, 25,26, 22, 32

P4: 3, 4, 15, 16, 17, 19, 20A, 22, 23, 24, 25,26, 22, 32

P5: 3, 4, 15, 16, 17, 19, 20A, 20B, 22, 23, 24, 25,26, 22, 32 (chosen P4 on purpose)

P6: 3, 4, 9, 10, 11, 19, 20A, 20B, 20C, 28, 30, 32 (chosen P2 on purpose)

P7: 3, 4, 6, 7, 8, 19, 20A, 20B, 20C, 22, 32

P8: 3, 4, 6, 7, 8, 19, 20A, 20B, 20C, 22, 23, 24, 22, 32

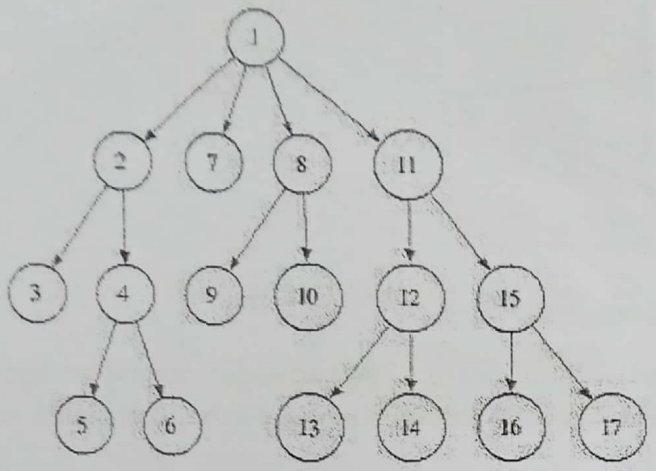
D. Design the test cases using an appropriate structure for the basis paths listed in part C. Input data must be a part of the test cases.

TID	Purpose	Input (a)	EO (Return Value)
1	Test P1, Sensitize P1	1	57
2	P2	—	infeasible path. (if at line 20 is false)
3	P3	—	infeasible path. (4)
4	P4	—	infeasible path
5	P5	4	63
6	P6	2	14
7	P7	—	infeasible path
8	P8	—	infeasible path

0100

Question 3 (Max. Marks = 1+1+2+2+2 = 8) CLO 4

Consider the following call graph for a system:



A. How many testing sessions are required if we perform pairwise integration of the underlying system?

16 OR E

B. How many testing sessions are required if we perform neighborhood based integration of the underlying system?

7 i.e. N-Sink

C. Write the nodes in neighborhood of 11: {1, 12, 15}

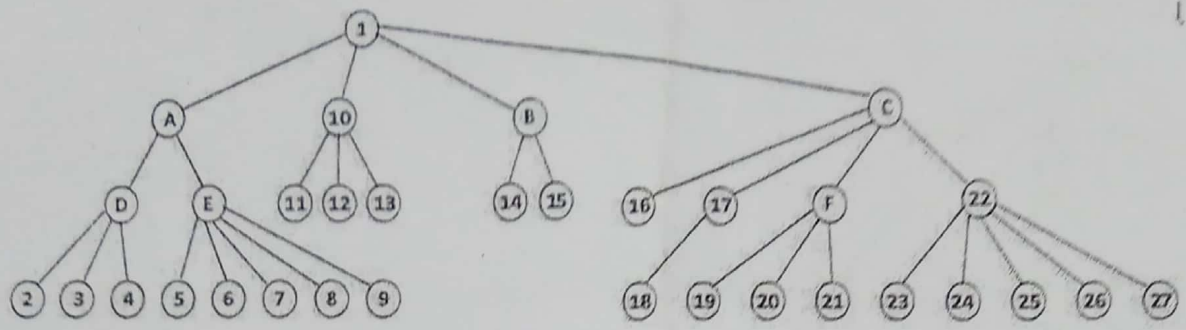
D. Write the nodes in neighborhood of 1: {2, 7, 8, 11}

E. Write the nodes in neighborhood of 13: {12}

Question 4 (Max. Marks = 12) CLO 4

0100

Consider the following functional decomposition of SATM System:



How many stubs, drivers, and testing sessions are required is we use different approaches for integration. Use the following table to solve this part. Do not leave any cell blank. **Explicitly write N/A** where a certain concept is not applicable:

Integration Approach	Stubs	Drivers	Test Sessions
Big Bang	N/A	N/A	1
Top-Down	33-1 = 32 nodes-1	N/A	10 + 32 = 42 nonleaves + edges
Bottom-Up	N/A	10 non leaves	10 + 32 = 42
Pairwise	N/A	N/A	N/A

requires a Call graph.

National University of Computer and Emerging Sciences, Lahore Campus

	Course Name:	Software Quality Engineering	Course Code:	SE3002
	Degree Program:	Software Engineering	Semester:	Spring 2022
	Exam Duration:	60 Minutes	Total Marks:	30
	Paper Date:	26th Sep, 2022	Weight	10%
	Section:	5A & 5B	Page(s):	4
	Exam Type:	Midterm-I		

Student : Name:_____ Roll No._____ Section:_____

Instruction/Notes:

Attempt all questions on the question paper. Answer sheets are not required.
Take Assumptions where required and note them down along with your answers.

Question #1:[2+1+1+1]

a) Define Quality

b) List different types of cost of quality

c) Briefly Explain the purpose of Quality models

d) Briefly describe the GQM model.

Question #2:[1+1+3]

Your Software Quality Assurance team has received a requirement specification document. You have been asked to assess the quality of the document

a) Is this activity called verification or validation? Explain why?

b) What testing technique(s) can you apply to test such work products?

c) Create a generic checklist of items that you will test to assess the quality of the requirement document

Question #5:[10 + 10]

Your company "Jiggle" has a product "JDocs", where people can create and manage their documents. This also has a feature to share documents. Currently you offer following options when sharing

- You can share Files or Folders
- You can give following access rights
    - read-only permissions
    - read and write permissions
    - Owner permissions
- You can share with
    - Individuals
    - All members of an organisation
    - Anyone that has the link

a) Create a reduced decision table to identify if the system should allow access to the user or not based on the different types of users that can request for the document

b) Create a Gherkin feature file to test this and use “Scenario Outline” to cover all required test cases in a minimum number of test scenarios