Proposed Solutions

1.
Error – a human action leading to a fault, e.g., programmer chose wrong variable
(0,5+0,5 marks)
Failure – the manifestation of a fault during execution of, e.g., wrong output (0,5+0,5)
Fault – the anomaly in the code (or specification) causing failure behavior, e.g., wrong
variable in a statement. (0,5+0,5 marks)

> *A programmer made a(n) __error___ which resulted in a(n)__fault__ in the code,*
> *which when executed, manifested itself as a(n)__failure___ (1 mark)*

2.
White box – test selection based on program internal structure (1 mark)
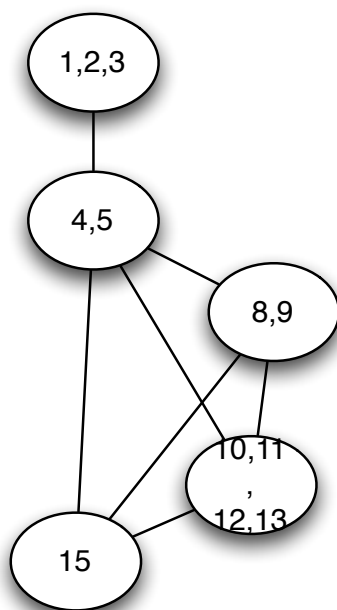Black box – test selection based on interfaces and specifications only (1 mark)

i black box only (1 mark)
ii both (1 mark)
iii white box only (1 mark)

3. Simplified (incomplete) graph

(2 marks)
MCC= E-N+2 = 7-5+2 (1 mark)
Or
MCC = d +1 where d is the number of decisions

Testcase	Age	Overspeed	Licenmark in	Licensmark out	Fine
1	30	20	0	0	2000
2	30	20	4	4	4000
3	30	40	4	5	9000
4	30	40	0	1	5000

 (2 marks)

def-use

Variable	Def	Use
Age	1	4, 8
Overspeed	1	4, 5, 9, 10
Licencemark	1	4, 8, 12
Licenemark	12	-
Fine	3	5, 9, 11
Fine	9	11

(2 marks)

Testcase	Age	Overspeed	Licenmark in	Licensmark out	Fine
1	30	20	0	0	2000
3	30	40	4	5	9000

(2 marks)

4.
combinations 3*2*2*2=24 (note: this was not asked – thus, not needed for full marks)
#2-way: (marks: 6*0.5 for the cases)

case	Operator	Network	Feature	Plan
1	Telia	3G	Voice	flat
2	Telia	WLAN	data	time
3	Tele2	3G	Data	flat
4	Tele2	WLAN	voice	time
5	Telenor	3G	data	time
6	Telenor	WLAN	voice	flat

#3-way: there are 4 different combinations of parameter 3-tuples. The total number of combinations of parameter values for 3-way interaction is as follows:

(operator, network, feature):   3*2*2 = 12
(operator, network, plan):   3*2*2 = 12
(operator, feature, plan):   3*2*2 = 12
(network, feature, plan):   2*2*2 = 8

Total   44

The minimum set of test cases is 12, as shown in the table below: (2 marks)

case	Operator	Network	Feature	Plan
1	Telia	3G	Voice	flat
2	Telia	WLAN	data	time
3	Tele2	3G	Data	flat
4	Tele2	WLAN	voice	time
5	Telenor	3G	data	time
6	Telenor	WLAN	voice	flat
7	Telia	3G	data	flat
8	Telia	WLAN	voice	time
9	Tele2	3G	voice	flat

10	Tele2	WLAN	data	time
11	Telenor	3G	voice	time
12	Telenor	WLAN	data	flat

5a. (3 – 1 mark for each aspect discussed; at least 3 aspects should be mentioned)
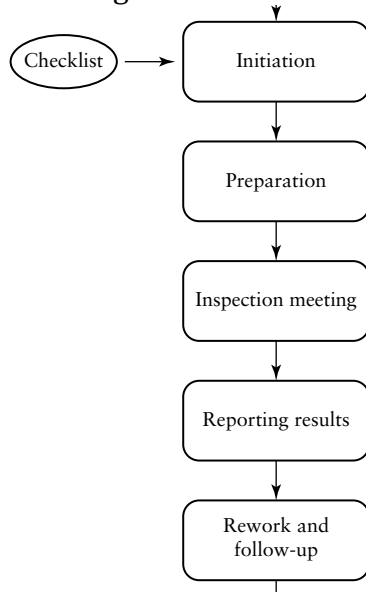
Review	Test
Static	Dynamic
Any artifacts	Code only
May start early in the process	Not until executable code is ready.
Manual	May be automated

5b) Inspection general (1 mark)
- manual and static scrutiny of work artefacts with purpose to find defects. Secondary goal to spread knowledge.

Process (2 marks)
Note: If figures are used in the solution, they must be explained!

Roles (1 mark)
   – Moderator – Reviewers (Inspectors) – Presenter – Author

Team (3 to 6 people) (1 mark)

6. (3*2 marks)
   a) quality is improved OR testing is different
   b) FT is 15 times more efficient, OR UT defects are not reported.
   c) Fix OR reject

7.
Note: the following example partitions are not necessarily the only possibility to come up with equivalence classes! The example is meant to give an idea of the level of detail expected to get full marks.

Example input classes:
- rebate/general/invalid debit card (1 mark)
- sufficient amount/not (1 mark)
- valid/invalid weight (1 mark)
Output class
- accept/reject (1 mark)

Classes
C1: rebate card
C2: general card
C3: invalid card
C4: sufficient amount
C5: insufficient amount
C6: valid weight
C7: invalid weight
C8: accept
C9: reject

Assumption: amount on the card is checked by other modules.
There may be more output classes, e.g. reject due to lack of money, invalid card, invalid weight

(3 marks) if each EC is included in at least one test case
TC1: rebate, 40kr, 1500 kg -> accept (C1, C4, C6)
TC2: general, 40kr, 1500 kg -> reject (C2, C5, C6)
TC4: invalid, 100kr, -1500kg ->reject (C3, C7)

8. (4*2 marks)

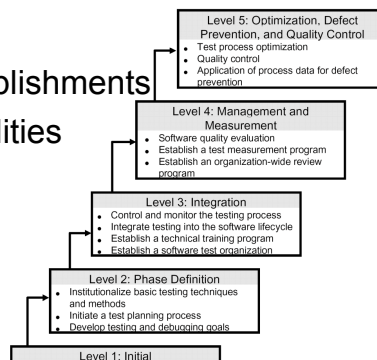|	I	Ii
Competence	Harder for mgmt. to cover both	Easier
Communication	Easier in the same org. unit	Harder
Management	Harder to manage two disciplines, easier thanks to shorter distance	Vice versa
Scale-up	May scale up and support cross-functional communication, but is harder to build up competence in the disciplines	May scale up to support large organizations, but may cause bureaucracy due to distance. Easier to build up specialized competency.

9.
Note: The following solution proposal only gives hints of what is expected – but, of course, correct solutions would comprise complete sentences and explanations of figures (if figures are used).

Structural description (1 mark)

Description of main focus for steps 2-5 (4 marks)

Test Maturity Model (TMM)

- Levels
- Maturity goals and sub-goals
    - Scope, boundaries, accomplishments
    - Activities, tasks, responsibilities
- Assessment model
    - Maturity goals
    - Assessment guidelines
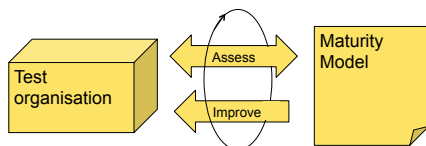   - Assessment procedure

Level 5: Optimization, Defect Prevention, and Quality Control
- Test process optimization
- Quality control
- Application of process data for defect prevention

Level 4: Management and Measurement
- Software quality evaluation
- Establish a test measurement program
- Establish an organization-wide review program

Level 3: Integration
- Control and monitor the testing process
- Integrate testing into the software lifecycle
- Establish a technical training program
- Establish a software test organization

Level 2: Phase Definition
- Institutionalize basic testing techniques and methods
- Initiate a test planning process
- Develop testing and debugging goals

Level 1: Initial

9b)
Assess with TMM as a reference
Improve with TMM as a guide
Repeat

Test organisation — Assess / Improve — Maturity Model

(3 marks)

Process improvement models

- (Integrated) Capability maturity model (CMM, CMMI)
- Software process improvement and capability determination (SPICE)
- ISO 9001, Bootstrap
- Test maturity model (TMM)
- Test process improvement model (TPI)
- Test improvement model (TIM)
- Minimal Test Practice Framework (MTPF)