

**Answer Sheet to be provided**

**Two Hours**

UNIVERSITY OF MANCHESTER  
INSTITUTE OF SCIENCE AND TECHNOLOGY

**CT210 Software Quality**

For candidates taking:

BSc IN COMPUTATION

SECOND YEAR SESSIONAL

BSc IN COMPUTING SCIENCE

SECOND YEAR SESSIONAL

BSc IN INFORMATION SYSTEMS ENGINEERING

SECOND YEAR SESSIONAL

BSc IN MANAGEMENT AND INFORMATION TECHNOLOGY

SECOND YEAR SESSIONAL

BSc IN COMPUTING AND GEOGRAPHY

SECOND YEAR SESSIONAL

MEng, BEng IN SOFTWARE ENGINEERING

SECOND YEAR SESSIONAL

MEng, BEng IN COMPUTER SYSTEMS ENGINEERING

SECOND YEAR SESSIONAL

Wednesday 30 May 2001

9.30-11.30

You must attach the answer sheet to your examination script

**One mark will be awarded for a correct answer.**

One quarter of a mark will be deducted for an incorrect answer.

No mark will be awarded/deducted if the question is not attempted.

If the question is worth more than one mark, these numbers will be adjusted in proportion.

The use of electronic calculators is NOT permitted

**Note: Do not answer more than the required number of questions. Clearly**  
cross out anything you do not wish to be marked.

PTO

UMIST, 2001

(2)

**Answer all questions to obtain maximum marks.**

**Some questions are awarded more than one mark.**

- 1) Which type of risk factor is most likely to cause problems for a software project developing a *Management Information System*?
  - a) Cost overruns
  - b) Low productivity
  - c) Cancellation of project
  - d) Difficulty in recruiting staff
  - e) Requirements creep

(1 mark)

2) *Defect prevention* is defined as:

- a) Avoiding defect insertion
- b) Avoiding defect insertion, but fixing errors when reported
- c) Finding and fixing errors after insertion
- d) Finding and fixing errors before release but after insertion
- e) Finding and fixing errors after release

(1 mark)

3) *Product quality* is defined as:

- a) Delivering a product using correct development procedures
- b) Delivering a product which is developed iteratively
- c) Delivering a product with correct requirements
- d) Delivering a product using high quality procedures
- e) Delivering an initial product and changing its once released to meet customer requirements

(1 mark)

4) *Maturity level* is defined as:

- a) The speed at which software can be produced
- b) A measure of the number of defects in a system
- c) A set of actions which when performed by the software development team meets a specific goal
- d) A well-defined stage which characterises an organisation's competence in delivering software
- e) The average age of the software development team

(1 mark)

(3)

5) The following diagram shows:



- a) An immature software organisation which generally delivers software on-time and within a reasonable range of its initial estimates
- b) An immature software organisation which generally fails to deliver software on-time and within a reasonable range of its initial estimates
- c) AN immature software organisation that undertakes a range of projects, some of which take a shorter period of time and others that are longer
- d) A mature software organisation which generally delivers software on-time and within a reasonable range of its initial estimates
- e) A mature software organisation which generally fails to deliver software on-time and within a reasonable range of its initial estimates

(1 mark)

6) Which maturity level is characterised by:

“Basic project management processes established to track cost, schedule and functionality. Has the necessary process discipline in place to repeat earlier successes on projects with similar applications”.

- a) *Level 5*
- b) Level 4
- c) Level 3
- d) Level 2
- e) Level 1

(1 mark)

(4)

- 7) The following *House of Quality* shows a set of customer requirements for a railway ticketing system on the vertical axis and a series of system functions along the horizontal axis.

		Fare/ refund calculati on	Ticket printing	Auditing and security	User interfac e	Customer tracking	Sum	%
Standard single/return tickets	48%	9	7	3	1	0	20	19%
Citizen charter refunds	4%	5	1	7	5	3	21	20%
Season tickets	33%	7	7	3	9	7	33	31%
Travelcards	15%	7	7	3	9	5	31	29%

Which observation is correct:

- a) The requirement *Standard single/return tickets* is the least important customer requirement  
 b) The requirement *Travelcards* is more important than *Standard single/return tickets*  
 c) The requirement *Citizen charter refunds* is about as important as *Standard single/return tickets*  
 d) The requirement *Standard single/return tickets* is supported by the system function *Customer tracking*  
 e) The requirement *Standard single/return tickets* is more important than all other requirements  
 (1 mark)
- 8) Using the *House of Quality* matrix in question 7, which observation is correct:
- a) The amount of system functionality contributing to the user requirement *Standard single/return tickets* is about right  
 b) The amount of system functionality contributing to the user requirement *Season tickets* is about right  
 c) The amount of system functionality contributing to the user requirement *Travelcards* is about right  
 d) *Citizen charter refunds* is not a valid user requirement  
 e) *User interface* is the most important user requirement  
 (1 mark)
- 9) Which type of risk factor is most likely to cause problems for a software project which has *Outsourced* development?

- a) High maintenance costs  
 b) Requirements creep  
 c) Legal expenses  
 d) Hidden errors  
 e) Lack of contractors

(1 mark)

(5)

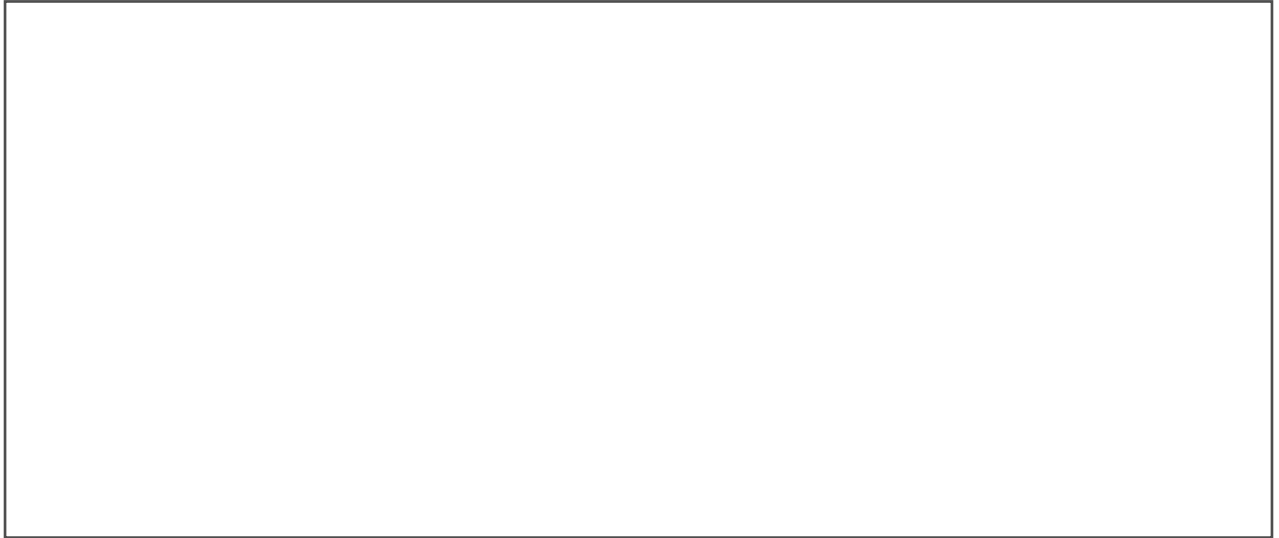
- 10) With respect to software metrics, which statement is NOT true:
- a) A *direct measure* focuses on attributes of a project which can be measured by examining a process, product or resource
  - b) A *indirect measure* focuses on attributes of a project which can be measured by examining a process, product or resource
  - c) *External attributes* are always measured indirectly
  - d) *Lines of code* is a *direct* measurement
  - e) None of the above, they are all true.
- (1 mark)
- 11) Measures for a project are given as:
- Effort: 12  
Cost: £24,000  
Thousand lines of code: 600k  
Defects: 120
- What is the *productivity* of the project?
- a) 0.1
  - b) 2000
  - c) 5
  - d) 50
  - e) 40
- (2 marks)
- 12) The key process area *Organisation Process Focus* is about:
- a) An organisation documenting all its software development procedures in order to improve its overall process capability
  - b) An organisation taking responsibility for software process activities that improves its overall process capability
  - c) An organisation examining its software development processes and trying to streamline them and remove redundant processes
  - d) An organisation trying to improve its overall process capability by introducing a testing programme
  - e) An organisation trying to improve its overall process capability by introducing focus groups.
- (1 mark)





(6)

13) With respect to the following IDEF model, which statement is NOT true:



- a) *Unnormalised structure* is a data input to process A1
- b) *2NF definition* is a mechanism used by process A3
- c) *Functional dependencies* is a data input to processes A3 and A4
- d) *2NF structure* is a data output from process A3 and a data input to process A4
- e) *Domain knowledge* is used to carry out process A2

(1 mark)

(7)

14) With respect to the following *Role Activity Diagram*, which statement is NOT true:

- a) A *purchaser* agrees change with a *purchasing manager*
- b) A *delivery date* is agreed sometime after a *requisition* has been passed by a *purchaser* and *purchasing manager*
- c) *Arrange finance* and *Inform warehouse* are carried out in parallel by *purchaser*
- d) *Identifying a supplier* involves a *supplier* and *purchaser*
- e) *Arranging finance* and *informing a warehouse* must occur before goods are supplied

(1 mark)

15) *Intergroup Communication* in the Capability Maturity Model (CMM) is primarily concerned with:

- a) Communication between developers and 3<sup>rd</sup> party supplier
- b) Communication between different customers
- c) Communication between the software engineering group and other stakeholders (including customers)
- d) Communication between customers and alternative supplier
- e) Communication between marketing staff and customers

(1 mark)

PTO

(8)

16) *Formal Reviews* seek to:

- a) Identify system faults, but not to attribute blame or seek solutions
- b) Identify system faults, attribute the source of errors, but not seek solutions
- c) Identify system faults, attribute the source of errors and seek solutions
- d) Identify system faults, seek solutions, but not to attribute blame
- e) Identify system faults, seeks solutions and punish the culprit.

(1 mark)

17) Use the following table for function point weightings:

Factors	Weights		
	Simple	Average	Complex

Number of user inputs	3	4	6
Number of user outputs	4	5	7
Number of user inquiries	3	4	6
Number of files	7	10	15
Number of external interfaces	5	7	10

A system being developed has the following characteristics:

Number of user inputs      10 (simple)  
 Number of user outputs    7 (simple)  
 Number of user inquiries   3 (average)  
 Number of files            6 (average)  
 Number of external interfaces 1 (complex)

The function point count for the system is:

- a) 27
- b) 31
- c) 58
- d) 140
- e) 141

(3 marks)

18) Which form of software development model is most suited to a system where all the requirements are known at the start of a project, but not all the resources required to deliver the project are available:

- a) Waterfall model
- b) Incremental model
- c) Evolutionary model
- d) Spiral model
- e) None of the above

(1 mark)

(9)

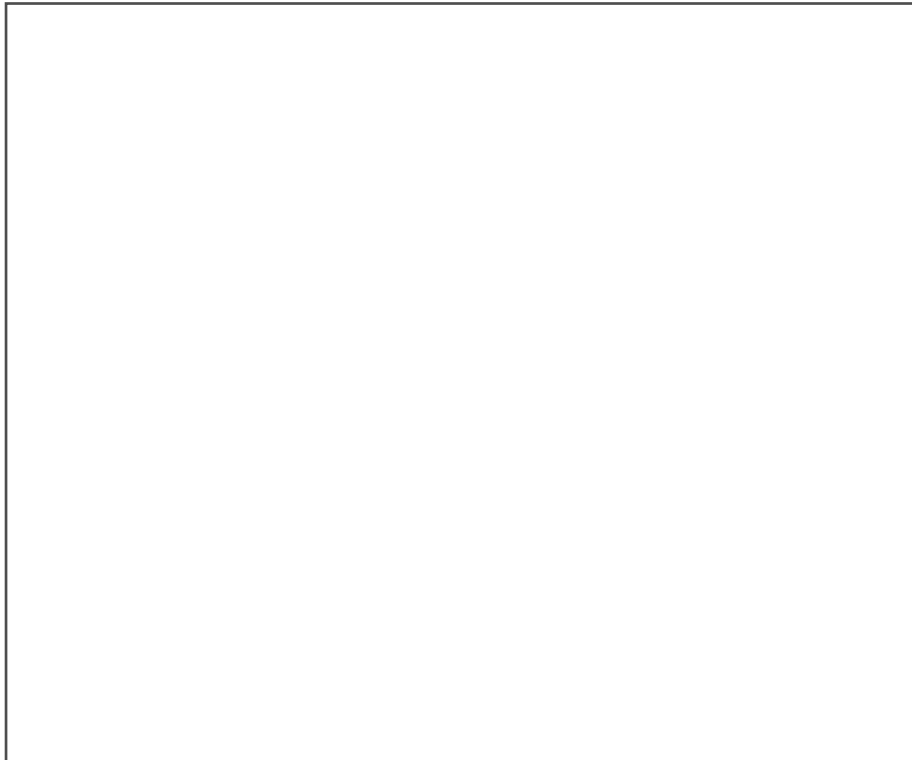
19) Which maturity level is characterised by:

“A focus on continuous process improvement, including defect prevention, technology change management and process change management”.

- a) *Level 1*
- b) Level 2
- c) Level 3
- d) Level 4
- e) Level 5

(1 mark)

20) With respect to the following state transition diagram for a software product, which statement is true:



- a) The product can be completed immediately after being compiled
- b) While the product is being compiled, it can only next be rewritten and under development
- c) Once the product has been completed, it can be rewritten
- d) Once the product has been tested, a check must be made to see if the compilation is OK
- e) While the product is under development it can only next be submitted for compilation

(1 mark)

(10)

21) Create a critical path network for the following set of activities

Task code	Task name	Duration	Starts after completion of task number(s)
PLAN	Plan project	3	
REQ	Capture requirements	8	PLAN
AGREE	Agree requirements with customer	2	REQ
DESIGN	Design system	10	AGREE
CODE	Code system	12	DESIGN
ID	Identify subcontractors	3	DESIGN
BUY	Buy-in subcontractor code	5	ID
INTEG	Integrate code and buy-in code	6	CODE, BUY
INFRA	Prepare infrastructure	7	AGREE
TRAIN	Train staff	5	INFRA
REL	Release system	4	INTEG, TRAIN

Using the critical path network you have constructed, identify which group of tasks lie on the critical path

- a) PLAN, REQ, AGREE and REL are the only tasks on the critical path
- b) DESIGN, ID, BUY and INTEG are on the critical path, as well as some other tasks
- c) DESIGN, CODE and INTEG are on the critical path, as well as some other tasks
- d) INFRA and TRAIN are on the critical path, as well as some other tasks
- e) ID and BUY are on the critical path, as well as some other tasks

(4 marks)

22) Using the critical path network you have produced for question 21, what is the expected end time of the project

- a) 35
- b) 36
- c) 41
- d) 43
- e) 45

(1 mark)

23) Using the critical path network you have produced for question 21, what is the earliest start time for the task INTEG

- a) 6
- b) 23
- c) 30
- d) 35
- e) 41

(1 mark)

(11)

- 24) Using the DIANE method of testing, which testing approach would be best for testing the following requirement:

“Personal data is to be encrypted prior to transmission to prevent unauthorised access during transmission and thus meet the requirements of the Data Protection Act”

- a) Demonstrate
- b) Inspect
- c) Analyse
- d) Not testable
- e) Execute

(1 mark)

- 25) Which statement is most correct in describing the reasons for moving to a higher level of the Capability Maturity Model:

- a) Improving quality and reducing the risk of errors
- b) Increasing programmer productivity
- c) Identifying areas of risk in the software development process
- d) Decreasing software development costs in the short term
- e) Improving programmer job satisfaction through meeting more customer requirements in a shorter time

(1 mark)

- 26) Consider the following cost estimates table for a number of system functions:

	Require-ments	Design	Code	Test	Integrate
Accept Executive club card	25	50	40	25	10
Retrieve booking	65	150	195	90	30
Display available seats	75	160	130	85	40
Assign seat	30	60	50	29	12
Print boarding pass	15	30	20	18	10

Which system function has estimates of some development steps which are disproportionate to the other system functions.

- a) Accept Executive club card
- b) Retrieve booking
- c) Display available seats
- d) Assign seat
- e) Print boarding pass

(2 marks)

(12)

27) What term does the following definition describe:

“...is about having an overall development and management process that provides the right environment for ensuring quality of the final product...”

- a) Quality achievement
- b) Quality control
- c) Quality management
- d) Quality assurance
- e) Quality enhancement

(1 mark)

28) Use the following table for function point weightings:

Factors	Weights		
	Simple	Average	Complex
Number of user inputs	3	4	6
Number of user outputs	4	5	7
Number of user inquiries	3	4	6
Number of files	7	10	15
Number of external interfaces	5	7	10

A system being developed has the following characteristics:

Number of user inputs      10 (simple)  
 Number of user outputs    15 (average)  
 Number of user inquiries   4 (average)  
 Number of files            6 (average)  
 Number of external interfaces 7 (complex)

- a) 768
- b) 251
- c) 42
- d) 50.2
- e) 153.6

(3 marks)

29) Systems with a function point count around 10,000:

- a) Are most likely to be successful projects
- b) Are most likely to be finished ahead of schedule
- c) Are most likely to be completed on-time
- d) Are most likely to be delayed
- e) Are most likely to be cancelled

(1 mark)

- 30) Which form of software development model is most suitable for a project with the following characteristics:
- before the start of the project the requirements are fully known and understood
  - during the development of the project, the users identify new requirements to be built into the next release of the software
  - after several releases of the software, the system becomes stable
  - over a period, the users recognise that the system has uses in a different business context and use the existing system as the basis for the development of a new system in one of the different business contexts
- a) Waterfall model  
b) Incremental model  
c) Evolutionary model  
d) Conceptual model  
e) Software development lifecycle model
- (1 mark)
- 31) Which of the following is NOT necessarily a critical success factor in developing a organisation process definition:
- a) The process must have relative advantage over what is in use  
b) The process must be adaptable and easy to use  
c) The process users must see a need and are ready for change  
d) The process must be defined by independent, third party experts in the field  
e) The organisation must support and encourage change as part of its culture
- (1 mark)
- 32) On a two-dimensional scale of Static-Dynamic and Formal-Informal, how would you classify the method entity-relationship (ER) modelling
- a) Static and formal  
b) Static with some formal aspects  
c) Dynamic with some formal aspects  
d) Dynamic and formal  
e) Static and dynamic with no formality
- (1 mark)
- 33) An organisation with a *role culture* is said to:
- a) Bring together appropriate resources and roles of individuals to get the job done  
b) Comprise a 'galaxy of individual stars'  
c) Depends upon trust and empathy for its effectiveness  
d) Have influence mechanisms based upon expertise rather than position  
e) Operate a culture where a job description is more important than the person who fills the job
- (1 mark)



(14)

34) How would you classify the following process problem:

“No check is made to ensure that the process is properly applied”

- a) Incompleteness
- b) Inconsistency
- c) Validation omission
- d) Transmission error
- e) Redundancy

(1 mark)

35) The following description is a definition of what term?

“... is the art of identifying, organising and controlling modifications to the software being built by a programming team. The goal is to maximise productivity by minimising mistakes”.

- a) Configuration management
- b) Productivity management
- c) Quality management
- d) Compatibility management
- e) Process management

(1 mark)

36) Level 5 of the CMM (Capability Maturity Model) is about:

- a) A process for the measurement of software processes
- b) Management of software product development process
- c) Delivering the benefits of levels 1 to 4 of the CMM
- d) Automating processes through the use of CASE tools
- e) A process for managing other processes

(1 mark)

37) Which of the following is NOT necessary for a successful product review:

- a) Identification of source of errors
- b) Limited number of qualified participants
- c) Short meeting
- d) Emphasis on error identification, rather than error correction
- e) All the above are necessary

(1 mark)

38) With respect to *measurement capability*, which statement is NOT true:

- a) Measurement of cause identification and defect prevention is a higher level capability than defect measurement
- b) Estimating and planning is at the same level of capability as product tracking
- c) Return on investment (ROI) is a higher level capability than process control
- d) Defect measurement is a higher level capability than process control
- e) Process control is a lower level capability than cause identification and defect prevention

(1 mark)

(15)

- 39) In the Capability Maturity Model (CMM), the key process areas *Software Product Engineering* and *Peer Reviews* appear at level 3, but to what aspect of the development and quality management process do they belong?
- a) Engineering
  - b) Management
  - c) Organisation
  - d) Process quality
  - e) None of the above

(1 mark)

- 40) The following diagram shows the relationship between time and the accumulation of defects in a software product. Line A represents the defects inserted into the software product; line B presents the defects detected and corrected in the software product and line C represents the point at which the software product is released for use.

To improve the quality of software, the aim is to:

- a) Reduce the time to line C, i.e. move line C earlier
- b) Move line B to the right and downwards
- c) Move line A to the left and upwards
- d) Move line A downwards and line B upwards to that they coincide by time C
- e) Move lines A and B downwards and to the right

(2 marks)

**END OF PAPER**

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Cumulative  
Defects

A

B

C

Time