9210-127
Level 6 Graduate Diploma in Engineering
Software engineering

Sample Paper

	You should have the following for this examination	**No additional data is attached**
	• one answer book	
	• non-programmable calculator	
	• pen, pencil	

General instructions
• This examination paper is of **three hours** duration.
• This paper contains **nine** questions.
• Answer any **five** questions.
• All questions carry equal marks. The maximum marks for each section within a question are given against that section.
• An electronic, non-programmable calculator may be used, but candidates **must** show clearly the steps prior to obtaining final numerical values
• Drawing should be clear, in good proportion and in pencil. Do **not** use red ink.

1   a) i)   Explain what is meant by software process. (1 mark)
        ii) Explain briefly four fundamental activities common to any software process. (4 marks)
    b) Explain two differences between a customized software product and a generic
        software product. (4 marks)
    c) A web-based system is going to be developed to manage complaints received by
        a large hospital. The idea is new and the requirements are not clear. An evolutionary
        approach is to be used for the system development with a throwaway prototype.
        i)   Explain the process of evolutionary approach in software development. (5 marks)
        ii) Explain one reason to justify the use of a throwaway prototype for this system. (2 marks)
        iii) Explain two disadvantages of using a throwaway prototype for this system. (4 marks)

2   a) i)   Explain function-related software matrices. (2 marks)
        ii) Give two examples for function-related software matrices. (2 marks)
    b) Explain two factors, which affect the productivity of a software engineer working
        in an organization. (4 marks)
    c) An organic-type software product is estimated to have 20 000 lines of code.
        The basic COCOMO model is used for this software's cost estimation.
        i)   State the equation of basic COCOMO model. (2 marks)
        ii) Explain two main conditions, which need to be fulfilled to obtain realistic
             estimates using basic COCOMO model. (4 marks)
        iii) Using the basic COCOMO model, find the effort required to develop the
             software product. (3 marks)
        iv) Explain a situation where the moderate level of COCOMO model is more
             suitable than the basic model. (3 marks)

3   a) Members of a school DVD library can rent DVDs. A single DVD can have one to three
        copies. There are four categories of DVDs, namely 'Documentary', 'Cartoons',
        'Education' and 'Classics'. A DVD can fall under one or more categories. Each
        DVD's name, id, producer, director, duration and categories are recorded when
        registering a DVD. Members can borrow two DVDs at a time for three weeks
        duration and if they are not returned on time a fine will be charged. The fine is
        calculated based on overdue dates and a predefined fine rate per overdue day.
        A software system is proposed to assist the librarian to manage the functions
        of the library.
        i)   Draw a semantic data model for the above system. Use simplified object
             classes without operations in the data model. (8 marks)
        ii) Draw a suitable design of a graphical user interface to register a DVD
             in the library. (6 marks)
        iii) Draw a use case diagram identifying the requirements of the DVD library
             system. At least two actors and one operation for each actor have to be used. (6 marks)

4   A computer software system for a stationery shop is designed using UML. The shop sells stationery items, books and toys. The books can be of type novel, short story or poetry. All books have an author, number of pages, publisher and a price. The records for the short story books need to keep the number of stories also. There are loyalty customers who frequently visit the shop and they receive discounts. Stationery items have a name and a price. Writing books are also stationery items and they are of different types.

   a)   State three classes, which can be used by the above system.   (3 marks)
   b)   Identify three attributes and three operations for two of the classes identified in a) above. Draw each class using the UML class notation.   (6 marks)
   c)   Explain the following object oriented design concepts based on the examples taken from the above scenario.
        i)   Inheritance.   (3 marks)
        ii)   Abstraction.   (3 marks)
        iii) Encapsulation.   (3 marks)
   d)   Identify two modules, which can be used in the software system for the stationery shop.   (2 marks)

5   a)   Explain the top-down approach in software testing.   (4 marks)
   b)   Differentiate between
        i)   black box testing and white-box testing   (4 marks)
        iii) software inspection and software testing.   (4 marks)
   c)   Briefly explain what is meant by alpha testing.   (3 marks)
   d)   'Large software projects are often 'one-off' projects. This fact makes software project management a difficult task'.
        Justify the above statement.   (5 marks)

6   a)   Table Q6a shows the activities of a particular software project with their duration and the dependencies.
        i)   Draw the activity network diagram using the information in Table Q6a.   (4 marks)
        ii)   Find the critical path of the project using the activity diagram.   (3 marks)
        iii) Find the minimum duration of the project using the activity diagram.   (1 mark)
        iv)   An activity network can be used to reduce the time taken for a project. Using the activity network drawn above as an example, explain one such method.   (2 marks)

Activity	Duration(days)	Dependency
A	2	–
B	3	A
C	5	A
D	2	A,B
E	4	C
F	3	D,E
G	2	C

Table Q6a

   b)   Briefly explain the four stages of the software risk management process.   (4 marks)
   c)   Differentiate between business risk and project risk.   (2 marks)
   d)   Categorize each of the following as a business risk or project risk and justify your answer.
        i)   A competitive product having similar features being marketed before a system is completed.   (2 marks)
        ii)   Some experienced staff leaving the project before the project is completed. (2 marks)

7 a) Differentiate between the static models and the dynamic models used in object oriented analysis and design. (4 marks)
   b) Give one example for each of the following.
       i) Static models. (2 marks)
       ii) Dynamic models. (2 marks)
   c) Explain the main features of software re-engineering. (6 marks)
   d) Briefly explain three characteristics of the cleanroom software development approach. (6 marks)

8 a) Explain a main advantage of the spiral model of software development over other approaches. (3 marks)
   b) Explain the main features of the waterfall model. (6 marks)
   c) Explain the main features of component-based software engineering. (5 marks)
   d) Select the best user interaction style category for user interface designs for the following scenarios.
       Briefly explain two reasons for each selection.
       i) An inventory control system used by a small factory. (3 marks)
       ii) Online game application. (3 marks)

9 a) Explain two examples of activities, which can be automated using computer, aided software engineering. (4 marks)
   b) Differentiate between functional requirements and non-functional requirements of a software system. (4 marks)
   c) Explain a non-functional requirement which can affect
       i) a patient information system (3 marks)
       ii) a web based examination system. (3 marks)
   d) 'Calculate the overtime payment' is a function of a payroll system. The overtime due amount is calculated based on the number of extra hours worked and the rate per hour. The number of extra hours worked has an upper limit and only the hours within the upper limit are eligible for payment.
       Write down the functional requirement specification of this function. (6 marks)