2910210 Software engineering and development

Examination paper: Zone B

Time allowed: three hours

Full marks will be awarded for complete answers to **four** questions. Do not attempt more than **four** questions on this paper.

A hand held calculator may be used when answering questions on this paper but it must not be pre-programmed or able to display graphics, text or algebraic equations. The make and type of machine must be stated clearly on the front cover of the answer book.

Question 1.

a. Explain each of the following properties of a software development process

i. Productivity

ii. Timeliness

iii. Visibility

[9]

b. Describe, with use of a diagram, the prototype and spiral processes of software development.

[10]

c. What are the benefits and costs of each of the processes you described in part b. Your answer should indicate under what conditions you would advise using each.

[6]

Question 2.

a. Describe the advantages and disadvantages of commenting your programs in terms of maintainability and long-term reliability.

[6]

b. State three items of information that should be part of the *header* comments of a module and briefly explain why these may be useful for people maintaining the code in the future.

[9]

c. Consider the following program fragment:

```
read float a;

float lower = 0.0, higher = 100.0; x = 50.0;

WHILE  ((x * x - a > 0.1) OR (x * x - a < - 0.1)9
     {
     IF   x * x > a  THEN higher := x
                     ELSE lower := x;
     x = (higher + lower) / 2;
     }
```

What does the program do and what would be a suitable header comment for it?

[10]

Question 3.

a. Testing can be divided into the following stages.

i. Unit Testing

ii. Integration Testing

iii. Validation Testing

iv. System Testing

Briefly describe each.

[8]

b. Distinguish, with the aid of an example or diagrams, between top-down and bottom-up integration testing.

[8]

c. Describe a test strategy for a system you have worked on, or otherwise know about. Your answer should incorporate all of the stages enumerated in part a.

[9]

Question 4.

a. Why is a knowledge of cognitive Psychology useful to software developers?

[5]

b. "Humans perform far better with concrete examples than they do with abstract entities"

Discuss this statement with reference to a Psychological experiment that bears this out and also discuss the implications for Software Developers

[10]

c. Discuss four guidelines you would lay down for a Software Inspection process and explain, briefly, why each of them is useful.

[10]

Question 5.

a. What are the basic components of a State Transition Diagram (STD) and what is the place of these diagrams in software development.

[10]

b. Draw a State Transition Diagram for a Central Heating Controller. The user of the controller chooses four times of the day, T1, T2, T3 and T4, and chooses whether the system comes on *once a day* and or *twice a day*.

The difference between the two settings can be seen in the following interval diagram:

The top intervals represents *on twice*, the second represents *on once*. Where there is a bar the heater is on, where there is no bar the heater is off. In both settings the heater is off between T4 and the next day's T1.

[15]

Question 6.

a. Explain the notions of 100% Statement Coverage, 100% Path Coverage, 100% Branch Coverage as they occur in white-box testing of software. Your answer should make it clear what the subsumes relation among the criteria is.

[5]

b. Make a Control Flow Graph for the following program:

```
                BEGIN
  [i]           READ y :- 1;
 [ii]           WHILE (x - 1) DO
                     {
[iii]                IF (y > 3) THEN
 [iv]                    { x :- x - 1; }
  [v]                  Y := y - 1;
                       }

 [vi]           IF (x mod 2 = 0) THEN
[vii]           { x :- x - y;}
[viii]            x :- 5;
                  }

                END.
```

[10]

c. Define a test set for 100% path coverage. Explain your reasoning. Especially comment on how your answer would be different if you were asked for 100% statement coverage.

[10]