Software Engineering – CS 345

Full Marks: 100   Time: 3 hrs

Answer all questions. No clarification will be given during the exam. Answer based on your understanding. You are free to make assumptions, if any.

Section A

Answer Q1-Q15 in <u>True/False</u> (no explanation needed). There is negative marking (-1) for each wrong answer. $15*2 = 30$

1. Two of the generic user classes are "novice" and "literate".
2. Norman's model of interaction consists of seven actions.
3. Objects are instantiation of classes.
4. There are 9 views that are represented through UML.
5. There are 3 components in an ER diagram.
6. Code inspection is a review-based code testing method.
7. Code walkthrough method is primarily used to check for adherence to coding standards.
8. In black-box testing, we should know the code structure.
9. Path coverage testing is a white-box testing method.
10. We can perform full system testing only in top-down fashion.
11. Driver routines are used in Bottom-up testing.
12. A larger test suite is always preferable for code testing.
13. In a paired sample t-test, $p=0.05$ indicates that the probability of getting the results by chance is about 95%.
14. The *extent* to which the observations made for a research question depends on the test condition is known as the "external validity" of the question.
15. In order to draw reliable conclusion from empirical data, we require at least 5 participants.

Answer Q16 – Q20 by selecting the correct option(s). More than one option may be correct. Marks will be awarded if all the correct options (only) are selected. There is NO negative marking. $5*2 = 10$

16. Identification of data structures and algorithms for different modules is done in which phase of the code design stage?
    a. Preliminary design
    b. High-level design
    c. Detailed design
17. Which of the following is/are to be avoided during coding?
    a. Use of module header
    b. Use of functions having 10 lines of code approximately
    c. Use of 'goto' or branching statements
    d. Use of large number of global variables in the code
18. Consider the sentence - "A book has many pages". Which of the following best characterizes the relationship between the book class and page class?
    a. Composition
    b. Inheritance
    c. Aggregation
    d. Association
19. Which of the following is/are valid steps for empirical research?
    a. Identification of research question(s).
    b. Solving equations.
    c. Design of experiment.
    d. Engineering for reliability.
20. Which of the following is/are valid statements in the context of empirical research?
    a. WPM (words per minute) is an example of a ratio scale of measurement.
    b. Independent variables are also known as factors.
    c. The practice effect is a control variable.

Section B

Explanation is optional in Q21 – Q25, unless explicitly asked for. There is NO negative marking for any of these questions.

21. Consider a function to compute square of an integer. It takes as input a positive integer (>0) and returns the square value (as integer) We wish to perform a black box testing for this function. Answer the following.
    a. [Mark 4] Considering only integer numbers, at least how many equivalence classes can be there? What are those classes?
    b. [Mark 4] Considering only integer numbers, at least how many boundary cases we should consider? What are those cases?

c. [Mark 2] Considering only integer numbers, what is the minimum size of the test suite?

22. Consider the following code snippet. You are asked to perform a white box testing following the path coverage method. Answer the following.

```
float averageCalc (int x, int y){
    int add = 0;
    float avg = 0;
    add = x + y;
    avg = add/2;
    return avg;
}
```

    a. [Mark 2] If we construct a CFG, how many nodes will be there?
    b. [Mark 2] How many edges will be there in the CFG?
    c. [Mark 2] How many linearly independent path(s) is/are there?
    d. [Mark 2] At least how many test cases we require to perform path coverage test for this code? Explain your answer in brief.
    e. [Mark 2] Is <2, 2> a valid test case? Explain your answer in brief.

23. Consider the following code snippet. You are asked to perform a white box testing following the path coverage method. Answer the following.

```
int complxCalc (int x, int y){
    int add = 0;
    If (x>y)
            add = x + y;
    Else
            Add = x;
    return add;
}
```

    a. [Mark 2] If we construct a CFG, how many nodes will be there?
    b. [Mark 2] How many edges will be there in the CFG?
    c. [Mark 2] How many linearly independent path(s) is/are there?
    d. [Mark 2] At least how many test cases we require to perform path coverage test for this code? Explain your answer in brief.
    e. [Mark 2] Is <2, 2, 0> a valid test case? Explain your answer in brief.

24. Suppose we want to evaluate an interactive system through empirical study. Answer the following.
    a. [Mark 2] We have framed a research question "my app performs well?" This is an example of a testable research question. (True/False)
    b. [Mark 2] Multiple testable research questions can lead to external validity of research questions. (True/False)
    c. [Mark 2] We can use a nominal scale to measure error rate. (True/False)
    d. [Mark 5] Our system is an interactive video game for teen agers. We propose to perform an empirical study with 20 persons (5 teen agers, the rest above 30 years of age). Can we conclude about the system performance from the study? Give a brief justification for your answer.
    e. [Mark 2] In the study, we collected two groups of data items from the participants, one for the system under evaluation and the other for another popular system of similar nature already available. We can use paired-sample t-test as a statistical significance test to compare the two group means. (True/False)

25. We developed a virtual keyboard for touch typing. We wish to perform an empirical study to determine usability of the keyboard. Answer the following.
    a. [Mark 5] we asked 5 users to type whatever they wish and took their feedback. All said the keyboard is good. Can we conclude it is indeed a good interface? Justify your answer in brief.
    b. [Mark 4] Instead of 5 users, can we make the conclusion if the number of users we employed was increased to 25? Justify your answer in brief.
    c. [Mark 4] One measure of usability is "user satisfaction". Can we measure it by testing the research question "can we type fast with the keyboard"? Justify your answer in brief.
    d. [Mark 2] We framed a research question and collected empirical data to test it using a between-subject study design. Accordingly, it was necessary to employ the Latin-square method to take care of the practice effect. (True/False)
    e. [Mark 2] If we wish to compare the typing performance (in words per minute) of our keyboard with two other designs already available, we can employ the ANOVA for statistical significance test of the empirical data. (True/False)