End Semester Examination – Semester IV
CSPE41 – Software Engineering

16 May 2023 | 2021 CSE

Marks: 40 | Duration: 3 hours | Instructor: C. Oswald

Note. Read the questions carefully. Your *logic* is more important than the answer.
Present your content as per the marks given. Marks are indicated in a bracket near the question.

0. Mention the grade you expect in this course + 2 lines justification. (0 m)

## Design Phase (CO2)

1. a. I hope you will enjoy your vacation from today. Let's assume our class representatives Antara and Srikanth have planned to co-ordinate a South India pleasure trip in the upcoming summer vacation. They are in need of a software (product) to efficiently plan and schedule the trip such a way that time, resources and effort are utilized optimally. You may creatively assume the necessary information required for a good design of the software. To start with the development of the software, draw a UseCase diagram and help them. (3 m)

b. The following domain model captures some basic information about a kids' karate club. In answering the following questions, state any assumptions that you make.
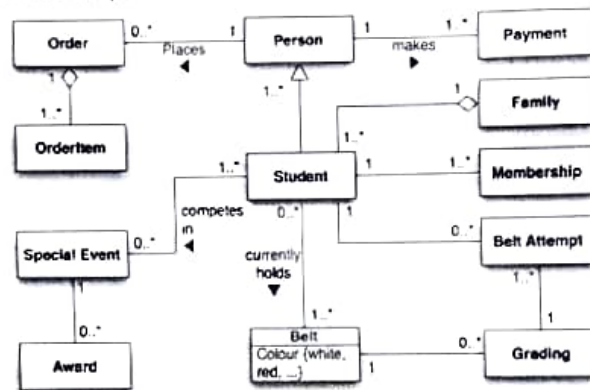


i) A student can only hold an award for a special event that he or she competes in. How would you modify the model to capture this constraint? Draw only the modification. (2 m)

ii) In the model, each student is shown as belonging to exactly one family. If this rule is enforced in a database, what problems could this lead to in rare circumstances? max. 4 lines (1 m)

## SDLC and Requirements Engineering (CO1)

2. a. Assume the following situation: In the first Scrum developer meeting, there is an agreement, that coding conventions should be used but there are conflicting views. An agreement on which coding conventions to use cannot be reached and the project cannot continue. More precisely, out of 7 group members, 3 insist that identifiers in code should use "CamelCase"(*a way to separate the words in a phrase by making the first letter of each word capitalized and not using spaces*), other 3 members insist that identifiers should use all lowercase letters and prefix the identifier with the type and underscore(like in "m_count"). The remaining group member abstains from giving an opinion, she doesn't care which coding conventions are established as long as some are.
How do you plan to resolve conflicts such as the one arising in this situation? How would the decision about which convention to adopt be made? max. 8 lines (2 m)

b. Remote Pair Programming System

Pair programming is an agile software development technique in which two programmers work together at one work station. One types in code while the other reviews each line of code as it is typed in. The person typing is called the driver. The person reviewing the code is called the observer. The two programmers switch roles frequently (possibly every 30 minutes or less).

Suppose that you are asked to build a system that allows Remote Pair Programming. That is, the system should allow the driver and the observer to be in remote locations, but both can view a single desktop in real-time. The driver should be able to edit code and the observer should be able to "point" to objects on the driver's desktop. In addition, there

should be a video chat facility to allow the programmers to communicate. The system should allow the programmers to easily swap roles and record rationale in the form of video chats. In addition, the driver should be able to issue the system to backup old work.

Describe in detail two non-functional requirements for the system. max. 2 lines for each. (2 m)

For example: Cost - users should pay no more than Rs. 100 per month to use RPP.

## Software Quality Metrics (CO3)

3 a. Estimate the effort E required to write the following program using Halstead's Software Science. Analyze the asymptotic time complexity of your algorithm (max. 5 lines). State the assumptions you make, in a clear way. (5 m + 2 m)

```
main() {
    int x, y, z, avrg;
    scanf("%d %d %d", &x, &y, &z);
    avrg = (x+y+z)/3;
    printf("avrg = %d", avrg); }
```

b. If you discover a bug or other issue, you should fix it to improve your code quality. What other engineering practices are essential to improving the code quality, typically after fixing the bug? 3 points with 3 lines each. (3 m)

c. A company need to develop digital signal processing software for one of its newest inventions. The software is expected to have 40000 lines of code. The company needs to determine the effort in person months needed to develop this software using basic COCOMO model. The multiplicative factor for this model is given as 2.8 for the software development on embedded systems. While the exponentiation factor is given as 1.20. What is the estimated effort in person months? (2 m)

## Software Testing (CO4)

4. a. Consider the following code (Euclid's GCD) below.

```
int f1(int x, int y) {
    while (x != y) {
        if (x>y) then
            x=x-y;
        else y=y-x;
    } return x;     }
```

i) Generate the number of linearly independent paths and a test case for each. (3 m)
ii) Generate a test case for statement coverage. (2 m)
iii) Generate a test case for branch coverage. (1 m)

b. Look at the following picture and comment on what it indicates based on the concepts discussed in the lectures. max. 6 lines. (2 m)



courtesy: https://codoid.com/software-testing-memes/

c. Using black-box program testing, you must determine if an array of numbers has any members with the same values. If it does, the program removes one of the equal numbers from the array and then continues to find and remove other equal numbers until all members are unique. Indicate a set of equivalence partitions (atleast 4) and its corresponding test cases you would use to test the program. (3 m)

d. You have been asked to test a method called catWhiteSpace in a "Sentence" that, within the sentence, replaces sequences of blank characters with a single blank character. Identify at least 2 testing partitions for this example and derive a set of tests for the cat WhiteSpace method. (2 m)

You may consider the input sentence: *Attitude is more important than marks.*

## Software Project Management, Project Scheduling (CO5)

5. a. A company needs to develop a strategy for software product development for which it has a choice of two programming languages L1 and L2. The number of lines of code (LOC) developed using L2 is estimated to be twice the LOC developed with L1. The product will have to be maintained for five years. Various parameters for the company are given in the table below.

| Parameter | Language L1 | Language L2 |
|---|---|---|
| Man years needed for development | LOC/10000 | LOC/10000 |
| Development cost per man year | Rs. 10,00,000 | Rs. 7,50,000 |
| Maintenance time | 5 years | 5 years |
| Cost of maintenance per year | Rs. 1,00,000 | Rs. 50,000 |

Total cost of the project includes cost of development and maintenance. What is the LOC for L1 for which the cost of the project using L1 is equal to the cost of the project using L2? (2 m)

b. For the Software Engineering course project you worked as a team, identify at least 10 tasks related to the Software Development Life Cycle(SDLC). Develop a Gantt chart(Timeline chart) along with the progress of each task. (2 m)
   Create a Task Network using the Gantt chart developed. (1 m)

***END***