CS 308
SOFTWARE ENGINEERING
Final Exam

Thursday, January 11, 2024 **12:30 - 15:00**

PLEASE NOTE:
PROVIDE ONLY THE REQUESTED INFORMATION AND NOTHING MORE. UNREADABLE, UNINTELLIGIBLE AND IRRELEVANT ANSWERS WILL NOT BE CONSIDERED. PLEASE ANSWER EVERY QUESTION ON THE SPACES PROVIDED. DO NOT FORGET TO FILL IN YOUR ID-NAME AND SIGNATURE IN EVERY PAGE (INCLUDING THIS PAGE).
THIS EXAMINATION CONTAINS 6 QUESTIONS AND 12 PAGES IN 6 SHEETS OF PAPER.

ID-NAME:
SIGNATURE:

Question	Maximum Points	Points Received
1	16	
2	8	
3	25	
4	15	
5	15	
6	21	
Total	100	

1) Answer the following questions about Model-View-Controller design pattern

a. (6p) What does each of the following concepts stand for when the pattern is used in web programming context

Model:

View:

Controller:

b. (6p) Describe the interaction between the following couples when the pattern is used in web programming context:

Controller-Model:

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View-Model:

View-Controller:

c. (4p) Describe **how** the following concepts play part in MVC pattern

Observer Design Pattern:

Dependency inversion:

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2) Define each of the following terms used in front-end programming:

UI Layout:

Box model:

Responsive UI:

Wireframe:

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3) Examine the following code written in C where the first parameter is a string represented as a character array and the **swap** function swaps two characters in the array.

```
01 void some_func(char *a, int left, int right) {
02   if (left == right) {
03       cout << a << endl;
04   } else {
05       for (int i = left; i <= right; i++) {
06          swap((a + left), (a + i));
07          some_func(a, left + 1, right);
08          swap((a + left), (a + i));
09       }
10   }
11 }
```

a. (10p) Draw the control flow graph for this function (Use line numbers)

b. (5p) Identify linearly independent paths for basis path testing (Use line numbers)

c. (10p) Provide test cases for boundary value analysis (a separate table for each function parameter)

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4) Assume that a hypothetical function

```
string interprete_bmi(int bmi_val, bool male_or_female, int age)
```

is used to provide information about a person's bmi value according to his gender and his age. During the function's execution there are three important value intervals for **`bmi_val`** parameter that indicates underweight, normal weight and overweight individuals and three different **`age`** intervals to indicate young, adult and senior individuals.

a. (5p) If combinatorial testing approach is applied how many different test cases would have been identified.

Your answer:

b. (10p) Apply pairwise testing and draw a table to identify the test cases that cover the whole parameter set.

Your answer, in this box only:

5) Examine the following hypothetical class definitions written in C++. Draw the corresponding UML class diagram.

```
abstract class Bird{
    private:
      Bird peer;
    protected:
      int wingspan;
    public:
      virtual void fly() = 0;
      void set_peer(Bird);
}
```

```
abstract class Mammal{
    protected:
      bool has_fur;
    public:
      virtual void feed() = 0;
}
```

```
class Bat : public Bird, public Mammal{
    private:
        double weight;
        BatEar ears[2];
    public:
        Bat(): ears{new BatEar(), new BatEar()}{}

}
```

Your answer, in this box only:

Student ID, Name and Signature:

6) Suppose that a team of 6 software developers are working on a project using the Kanban methodology. The team is a cross functional team of equal expertise and talent consisting 1 analyst as a customer proxy, 3 developers and 2 testers/deployment managers. Consider the arrival times and effort requirements of the following tasks (assume that the tasks have no interdependencies):

Arrival day	Task ID	Analysis Effort (man.day)	Development Effort (man.day)	Test/Deploy Effort (man.day)
Day 1	T1	1	2	1
Day 1	T2	3	2	2
Day 1	T3	2	1	3
Day 1	T4	1	1	2
Day 2	T5	1	3	1
Day 2	T6	1	3	1
Day 2	T7	2	4	1
Day 3	T8	2	3	2
Day 3	T9	1	2	1
Day 3	T10	1	1	1
Day 4	T11	2	2	3
Day 4	T12	1	1	2

a) (16p) By using the Kanban board template below, please draw the situation of Kanban board at the end of Day 2, 4, 6 and 8. You may indicate a group of tasks as (TX-TY) such as (T1-T3) for T1, T2 and T3

Day 2:

Backlog	Analysis	In development	Development Done	Testing/Deploying	Task Done
	(2)	(4)		(2)	

Day 4:

Backlog	Analysis	In development	Development Done	Testing/Deploying	Task Done
	(2)	(4)		(2)	

Day 6:

Backlog	Analysis	In development	Development Done	Testing/Deploying	Task Done
	(2)	(4)		(2)	

Day 8:

Backlog	Analysis	In development	Development Done	Testing/Deploying	Task Done
	(2)	(4)		(2)	

b) (5p) How many days it requires for the team to finish the enlisted tasks if they use the Kanban board template depicted in (a).