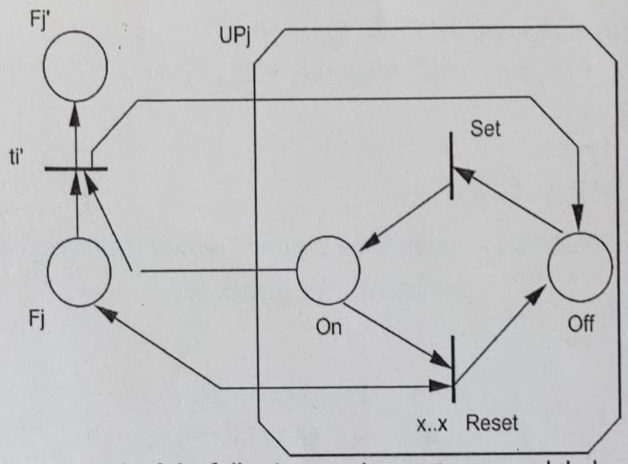
[U19CS012]

Department of Computer Science and Engineering, SVNIT, Surat.
End-Semester Examinations, December 2022
B.Tech. - IV (CSE)-7th Semester
Course: Software Engineering (CS401)

Date: 12/12/2022 **Time: 2 PM to 5 PM** **Marks:50**

Q1 (a) Software qualities are classified as **External (visible to the users of the system)** or **Internal (concern the developers of the system)** and **Product (what is delivered to the customer)** or **Process (process to produce software product)**. Classify the following software qualities in the above categories. Give proper justification: **5**
(1) Reliability (2) Robustness (3) Timeliness (4) Productivity (5) Visibility

Q1 (b) Consider the case study of the controlling software of Elevator discussed in class. Consider the petri net model shown in below figure shows how floor buttons UP_j ($1 <= j <= m-1$) are switched off. The time to service the floor is x seconds. Transition ti' indicates moving of an elevator in upward direction and has $t_{min} = t_{max} = 0$. Token in F_j indicates that the elevator is at floor j. Token in On and Off indicates that the UP floor button of floor j is on and off respectively. **5**



Analyze the above model and state which of the following requirements are modeled using this model:
(1) As soon as the elevator arrives at floor F_j, the UP_j button should be switched off.
(2) The UP_j button is switched off as soon as elevator has started moving in the upward direction from floor j.
(3) Reset transition will be fired when there are no pending requests.
(4) The ti' transition is given higher priority than Reset transition.
(5) The Set transition is given higher priority than ti' transition.

Q2 Answer the following (Any Eight): **20**

1. Using logic specification, specify a procedure that is intended to merge two sorted arrays into a single one. You should distinguish two different cases:
(1) Duplicate elements in input arrays should appear as duplicates in the output array.
(2) Input and Output arrays should contain no duplicate elements.

2. Using Finite State Machine, specify a software system with two lamps and one button. When the lights are off, pushing the button causes the first lamp to go on. Pushing the button again causes the second lamp to go on and the first to go off. Pushing the button yet again causes both lamps to go one and pushing it once more switches both lamps off.

3. Specify the following using a decision table.
There are three types of tax-payers-male, female and senior citizen. A male tax-payer pays 10% tax for income of more than Rs 1,60,000 and less than Rs. 3,00,000. A female pays 10% tax, if her income is more than Rs. 1,80,000 and less than Rs. 3,00,000, and a senior citizen pays 10% tax, if his income is more than Rs. 2,10,000 and less than 3,00,000. If a tax -payer income is more than 3,00,000 and less than 6,00,000, he has to pay 10% tax up to 3,00,000 + 20% tax on the income which is more than 3,00,000. If the income is more than 5,00,000 and less than Rs.10,00,000, then he has

to pay tax up to income Rs. 5,00,000 + 30% tax on the income which is more than Rs. 5,00,000. If the income is more than Rs. 10,00,000, then a tax-payer has to pay tax on the income up to Rs. 10,00,000 + 40% tax on the income higher than 10,00,000.

4 Explain basic rules in Data Flow Diagram (DFD) decomposition and show the unbalanced DFD using example.

5 Suppose two programs have been written to implement essentially the same functionality. How can you determine which one of these is more testable?

6 Give an example of a C program error that may not cause any failure.

7 Explain Unit testing using Driver and Stub modules.

8 Is it a good idea to thoroughly perform any one the black-box or white box testing and leave out the other? Justify your answer with suitable arguments.

9 Write the informal requirement of the controlling software of the elevator system using the following formal logic specification (Dt_s is the fixed service stop time):

stop (E, F, T_a) and list (E, L, T_p, T) and
$T_p > T_a + Dt_s$ and list (E, empty, $T_a + Dt_s$, T_p) and
first (L) > F
implies
departure (E, F, up, T_p)

Q3 (a) Consider the following Euclid's GCD computation function and answer the following: 10

```
int compute_gcd(x, y)
    int x, y;
{
  1  while (x! = y){
  2     if (x>y) then
  3              x= x – y;
  4     else  y= y – x;
  5  }
  6  return x;
}
```

(a) Design a statement coverage-based test-suite
(b) Design a branch coverage-based test suit
(c) Draw a Control Flow diagram for the function.
(d) Calculate the McCabe's Cyclomatic Complexity metric of the control flow graph using (1) number of edges and nodes and (2) number of non-overlapping bounded areas
(e) State some uses of McCabe's Cyclomatic complexity metric.

Q3 (b) Suppose you wish to develop a word processing software that would have features similar to Microsoft Word. Write five functional and five non-functional requirements for this word processing software. 5

Q3 (c) Specify Abstract Data Type INTEGER using algebraic specification technique. 5
Consider the following operations:
Zero: to Create an empty(zero) integer,
Succ: to find successor of an integer,
Equal: to check if two integers are equal,
Add: to add two integers