National University of Computer and Emerging Sciences

Formal Methods (SE2003)

Date: 27th February 2024

Course Instructor(s)

Dr.Wafa Basit

Sessional-I Exam

Total Time: 1 Hours

Total Marks: 40

Total Questions: 2

Semester: SP-2024

Campus: Lahore

Dept: Software Engineering

_____   _____   _____   _____

Student Name   Roll No   Section   Student Signature

_____   _____

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Instructions
- Make assumptions where necessary
- In case of multiple solutions, mention the final one
- All Questions have to be attempted on question paper.
- Please draw neat and understandable diagrams
- Use of lead pencil is not allowed.

Q1:   [5+5+5+5+5+5 =**30 marks]**

A university has a system for keeping track of its Students academic progress. If the **set** of all people is **Student**, and the **set** of all CGPAs is **CGPA**, then the information provided by the system may be described by a relation where is of type **Student↦CGPA**. It is impossible for a student to have two CGPAs at once, so this relation will be a partial function.

We use a Z schema to describe the structure of Students' CGPAs, **Progress** contains all information about students and their CGPA.

_StudentCGPA_____
| _Progress_:_Student↦CGPA_
|
|_____

  Note: Only write the success scenarios for each operation. Don't use the names of input and output variables that are same as the existing key words. Write necessary pre and post conditions

a) When a **StudentCGPA** schema is initialized, it contains no information about CGPA of any Student, so the value of **Progress** should be the empty function. The following schema describes the initial state of a **StudentCGPA**

StudentCGPAInit _____

_____

_____

b) A successful retrieve operation requires an existing Student as input and provides the corresponding current CGPA as output. It leaves the system unchanged.

RetrieveStudentCGPA _____

_____

_____

c) A successful Update operation replaces the CGPA stored under an existing Student, and provides no output.

UpdateStudentCGPA _____

_____

_____

d) A successful delete operation requires that the Student in question exists. A single input is required, and the state of the system will change after the particular Student's CGPA will be deleted:

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DeleteStudentCGPA

e) A successful add operation has a complementary precondition. This time, the Student P? must not be in the domain of StudentCGPA. A new entry shall be made containing information about a new Student's CGPA.
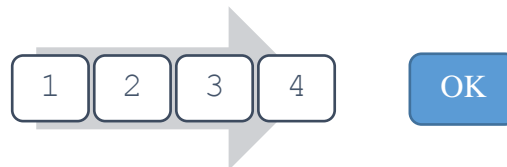
AddStudentCGPA

f) An unsuccessful add operation has a complementary precondition. This time, the Student P? is in the domain of StudentCGPA. A new entry shall not be made and a message will be displayed telling that the student already exists.

Student_already_exists

Q2: Following is the interface of an ATM machine where the user enters a 4-digit pin code. The user enters the digits one by one. If the user presses the OK button such that all digits are not entered, the transaction is rejected and the user has to enter the pin again. Otherwise the transaction is successful. Draw a Petrinet for the scenario mentioned above [10 marks]

-------Good Luck-----