ISS MIE-III- the 31 of May 2021

Working time 2h, 1pt by default

I. Let consider the 2 diagrams represented below.

a. Please mention which of these is correct (if there exists one) an justify why. Also, please explain the functionality of these diagrams. 1 pt

b. Enumerate and exemplify the concepts represented in diagrams. 1 pt

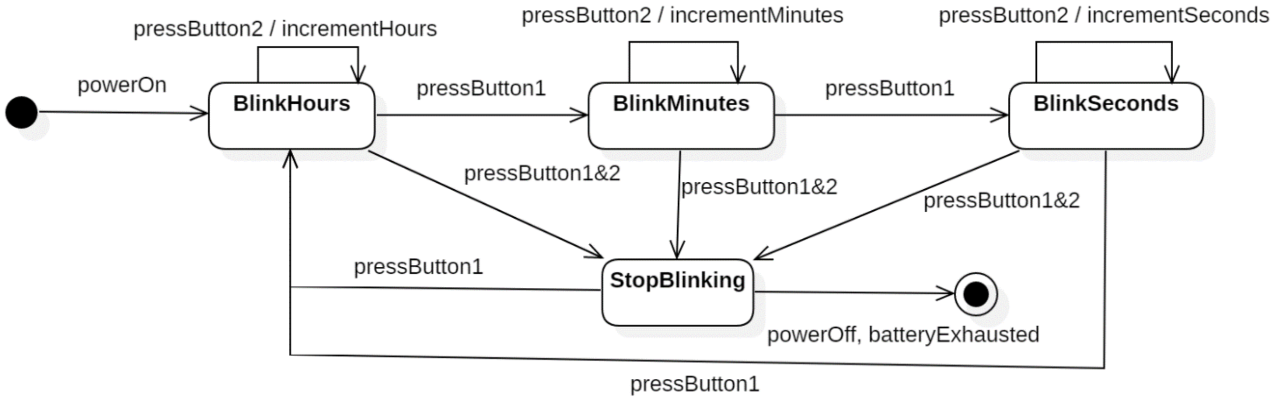


Diagram 1

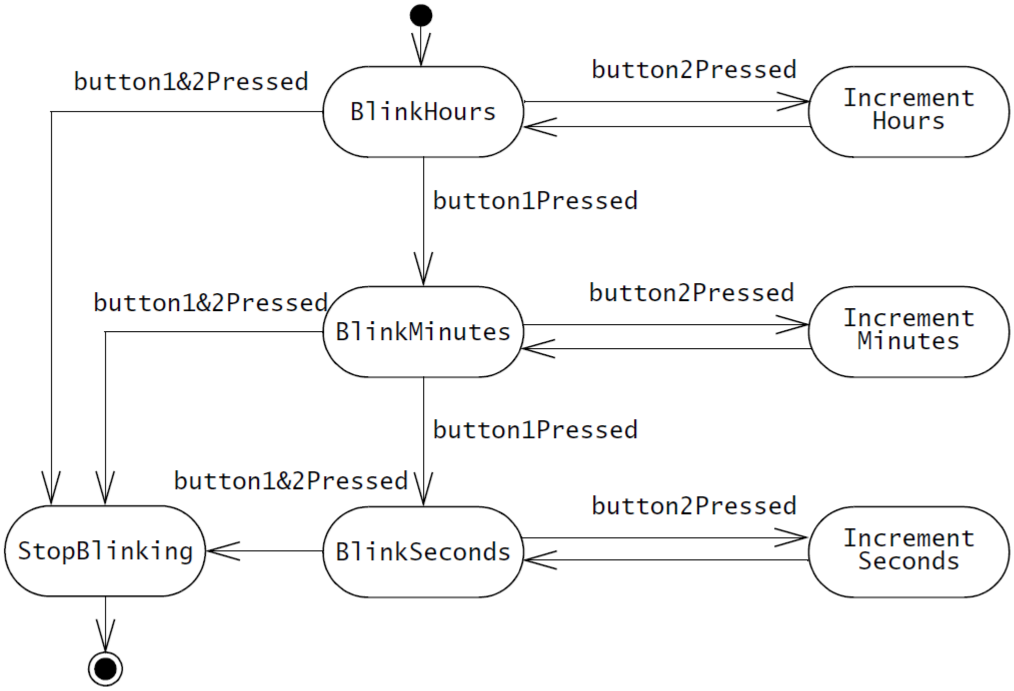


Diagram 2

I a - Both diagrams are State Transition Diagrams. The first diagram is the only correct one, simply because in the second one, the events triggering transitions are not mentioned for all states. For example, what happens if the component is in the state BlinkSeconds and the button1 is pressed. Moreover, the states IncrementHours, IncrementMinutes, IncrementSeconds are debatable from the point of view of the transitions towward states Binnk* because the transitions are not triggered from an event. Contrary, in the first diagram, the auto-transitions trigered when pressButton2 apears are associated with appropriate activities incrementHours/Minutes/Seconds.

I b - The elements of diagrams are:

- Simple/concreteStates: blinkHours, blinkMinutes, blinkHoursSeconds, stopBlinking
- Events/triggers: button1Pressed, button2Pressed, pressButton1&2, powerOn, powerOff, batterExhausted
- Actions: IncrementHours, IncrementMinutes, IncrementSeconds
- Pseudostates: InputState, OutputState

II. A faculty has a set of admitted students and a set of teachers which give courses. Each student is inscribed at a part of courses proposed by the faculty. At the end of each course, students inscribed are evaluated. The evaluation result is an integer mark in the interval {1, 2, …, 9, 10}. The evaluations are done at a planned date, usually by teachers giving the courses. If a student is absent at an evaluation, then his mark will be 0 (by default). Students and teachers are characterized by names and Ids. Students and teachers Ids values are unique in the context of a faculty. Courses are characterized by name and credits which are natural numbers in the interval {1, ..., 6}. The faculty has a name.

a. Using the UML language, please construct a class diagram complying with the above-mentioned requirements. 2 pt

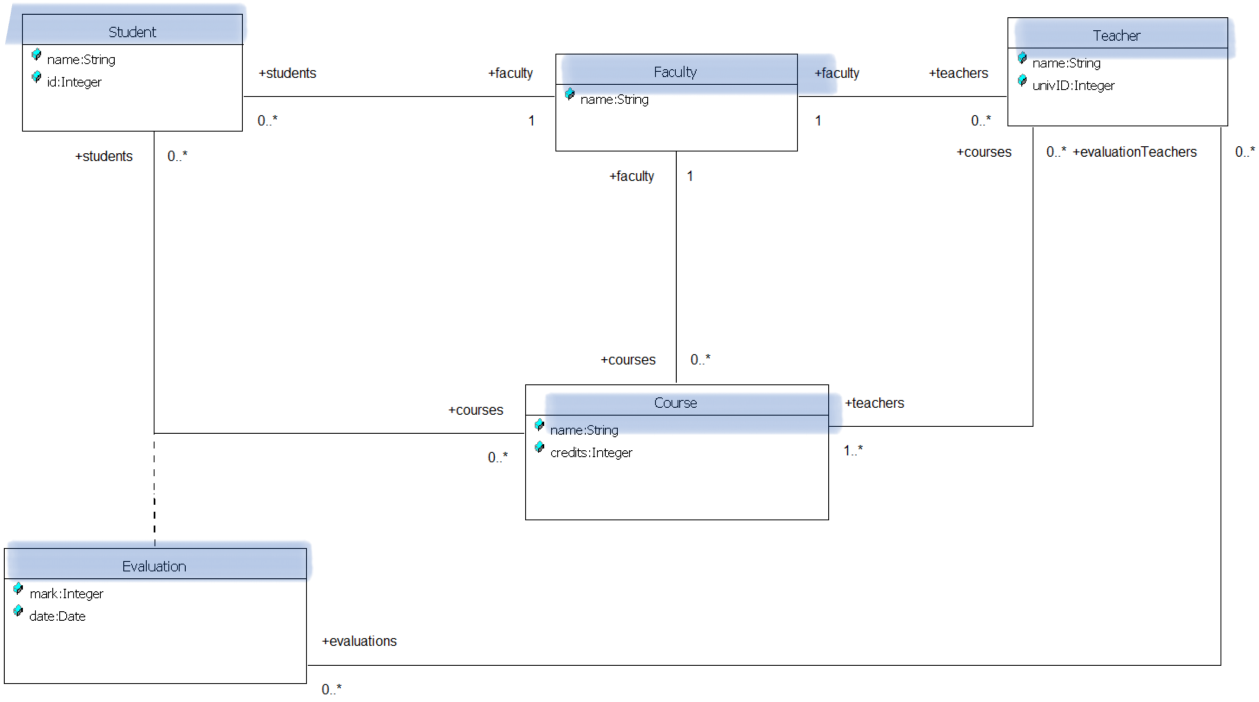
b. Using the OCL, please complement the model represented by the class diagram with: 2 pt

   i. an invariant specified in the Student class which states that each student Id must be unique in the context of the faculty,

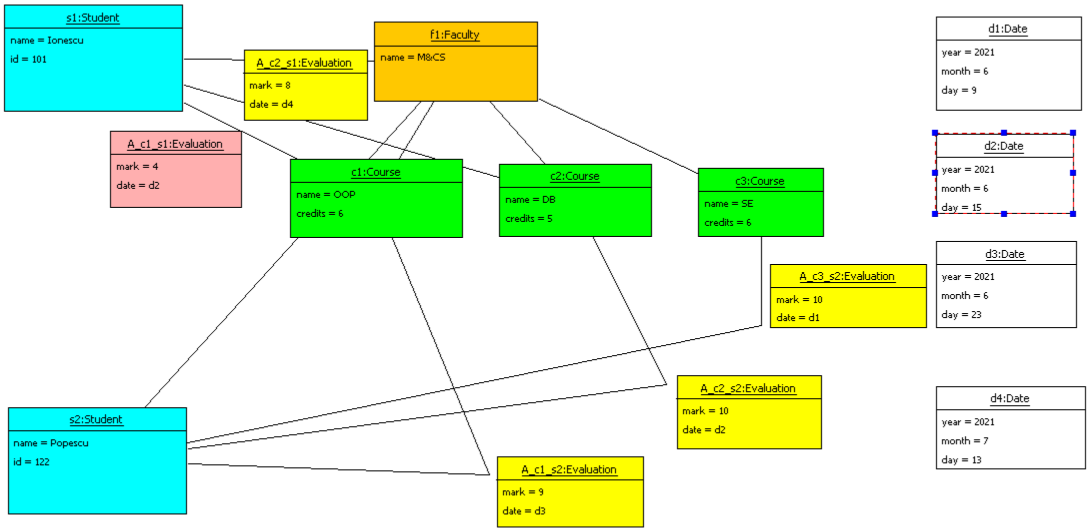
   ii. another invariant specifying that teachers doing the evaluation are among teachers giving the course associated with the evaluation,

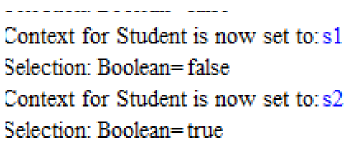
   iii. an observer returning true if a student passed (marks >= 5) all evaluations of his courses.

c. Represent two snaphots in which a student passed all evaluations (and it was evaluated at least twice for the same course to obtain a passing mark) and another in which fails. 1 pt



```
context Student
     inv uniqueStudId:
        self.faculty.students.id->count(self.id) = 1

context Evaluation
     inv aprTeachers:
        self.courses.teachers->includesAll(self.evaluationTeachers)

context Course
     inv courseEvaluationTeachers:
        self.teachers->includesAll(self.evaluation.evaluationTeachers)

context Student
     def passedCourseEvaluations:
        let passCE:Boolean = self.courses->reject(c | c.evaluation->exists(e | e.mark >= 5 and e.students=self))->isEmpty

context Student
     def passedCourseEvaluations2:
        let passCE2:Boolean = self.courses->reject(c | c.evaluation.mark->exists(m | m >= 5))->isEmpty
```

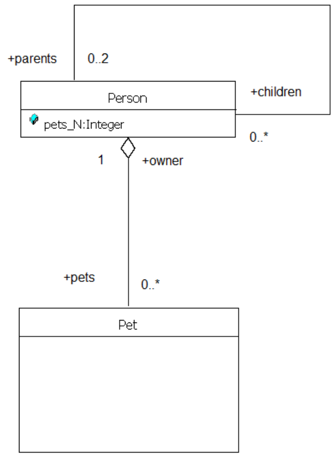




```
Context for Student is now set to: s1
Selection: Boolean= false
Context for Student is now set to: s2
Selection: Boolean= true
```

In the diagram above, the student passed all evaluations. Due to a bug of the OCLE Object Editor, I was not able to represent another linkObject. Initially the c1_s2Evaluation linkObject contained the mark 0 (absent) but, unfortunately, I was not able to represent another linkObject having a passingMark.

III. Let consider the class diagram bellow:



and the two excerpts of Java code:

```
public class Person {

    public final Set getChildren() {

        if (children == null) {
            return java.util.Collections.EMPTY_SET;
        }
        return java.util.Collections.unmodifiableSet(children);
    }

    public final void addChildren(Person arg) {

        if (arg != null) {
            if (children == null) children = new LinkedHashSet();
            if (children.add(arg)) {
                arg.addParents(this);
            }
        }

    }

    public final void removeChildren(Person arg) {

        if (children != null && arg != null) {
            if (children.remove(arg)) {
                arg.removeParents(this);
```

Figure 1 – Java code

```
public class Person {

    public final Set getChildren() {

        if (children == null) {
            return java.util.Collections.EMPTY_SET;
        }
        return java.util.Collections.unmodifiableSet(children);
    }

    public final void addChildren(Person arg) {

        if (arg != null) {
            if (children == null) children = new LinkedHashSet();
            if (children.add(arg)) {
                arg.addParent(this);
            }
        }

    }

    public final void removeChildren(Person arg) {
        if (children != null && arg != null) {
            if (children.remove(arg)) {
                arg.removeParent(this);
```

Figure 2 – Java code

Please mention if one or both excerpts of code were automatically generated or not and explain your statements. 2 pt

Between the model and the code, we need a full conformance. In the model, one opposite associationEnd of the recursiveAssociation is named parents and not parent. So, the excerpt included in Figure 1 including `arg.addParents(this);` and `arg.removeParents(this);` is the correct one and not `arg.addParent(this);` and `arg.removeParent(this);` from Figure 2. The excerpt from the Figure 1 was automatically generated. The excerpt from the Figure 2 was changed, so, not automatically generated.