Software Engineering

Books or notes are **not** allowed.
Write only on these sheets. **Concise** and **readable** answers please.

Surname, name, matricola ____

School management, grades and presence
In a school (secondary, tertiary level) a certain amount of administrative information has to be managed. The list of students and the classes they are enrolled in. Day by day, what the teacher has taught in a certain hour in a certain class (class log), the marks given to students in a certain subject, the absence / presence of a student in a certain day. At the end of a term grades must be aggregated and a school report is produced for each student.

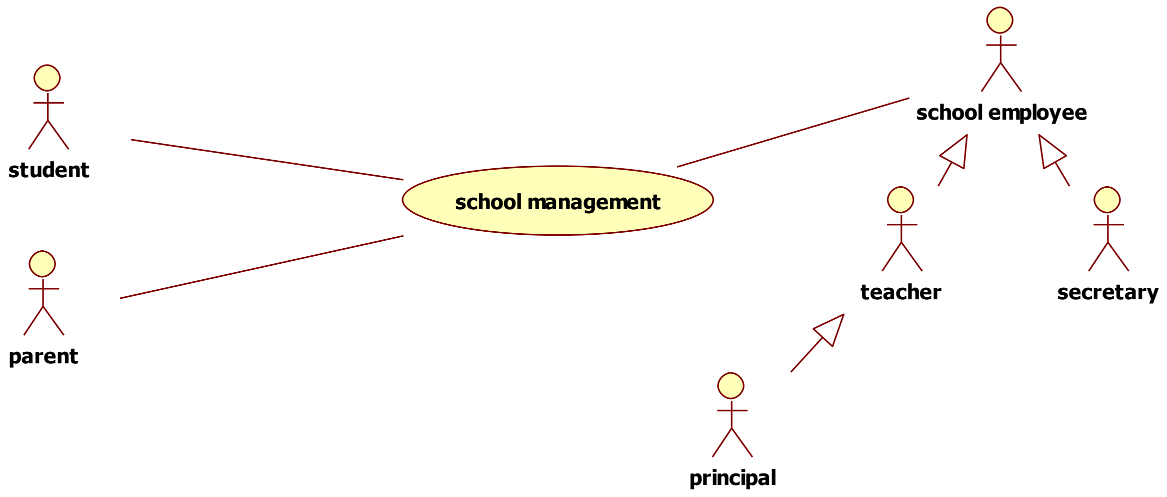
In the following you should analyze and model a client server application to support school management.

You should consider

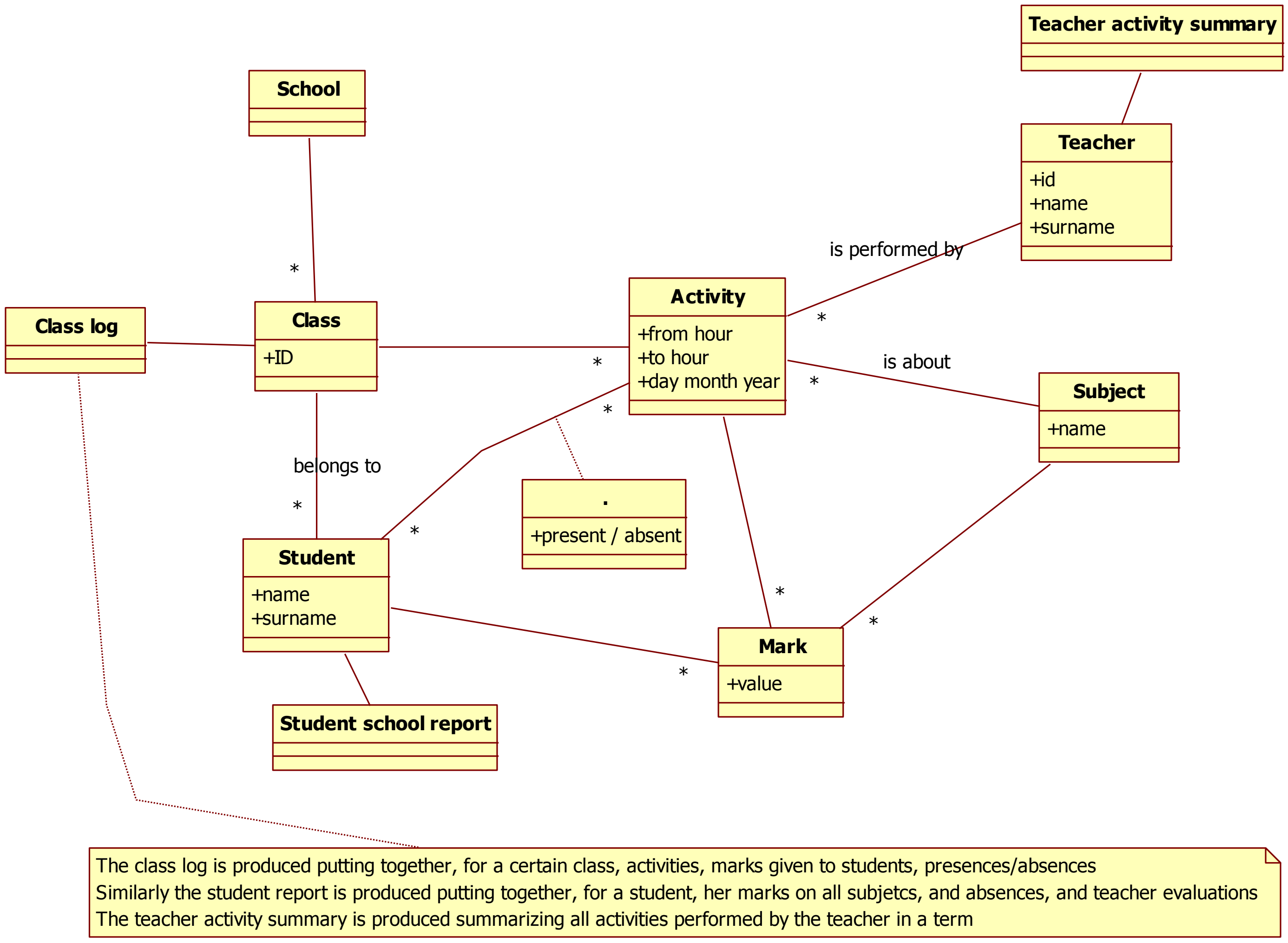
- Set up for a certain academic year (classes, students per class, teachers, teachers per subject)
- Management of the class log (log of activities performed in a class per day, per subject)
- Management of absences (log of students present / absent per day)
- Management of marks (marks given by teacher to student per subject); view and signature of marks by parent
- Production of school report per term per student (final mark per subject per student); view by parent
- Production of teacher activity summary, per teacher per term; view and approval by principal

1 – a. Define the **context diagram** (including relevant interfaces)

Actor	Physical interface	Logical interface
Parent, student	PC / smartphone	GUI
Teacher, principal	PC / smartphone	GUI

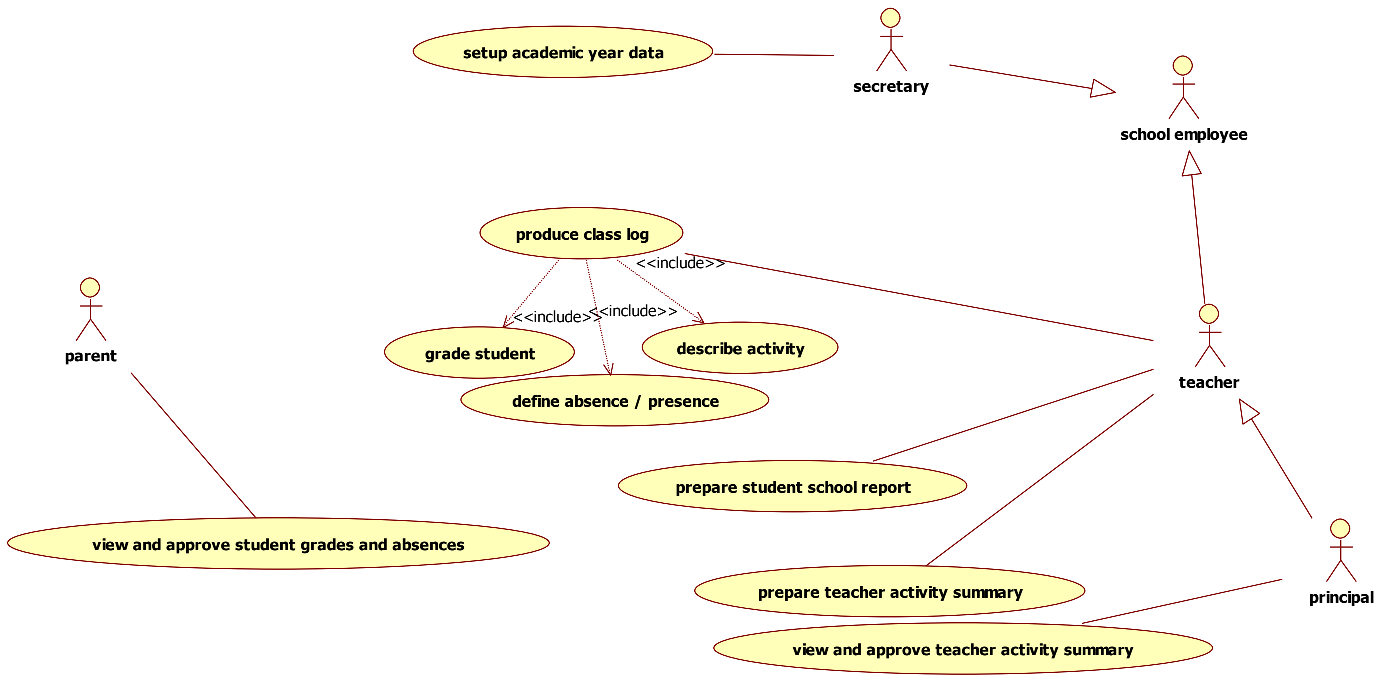


1-b Define the **glossary** (key concepts and their relationships) (UML class diagram) for the application


Teacher activity summary
School
Teacher
+id
+name
+surname
is performed by
Class log
Class
+ID
Activity
+from hour
+to hour
+day month year
is about
Subject
+name
belongs to
.
+present / absent
Student
+name
+surname
Mark
+value
Student school report
*
The class log is produced putting together, for a certain class, activities, marks given to students, presences/absences
Similarly the student report is produced putting together, for a student, her marks on all subjetcs, and absences, and teacher evaluations
The teacher activity summary is produced summarizing all activities performed by the teacher in a term

1-c Draw the Use Case Diagram for the application. For each Use Case give a short description here

Use Case ID	Description


setup academic year data
secretary
school employee
produce class log
<<include>>
<<include>>
<<include>>
parent
grade student
describe activity
define absence / presence
teacher
prepare student school report
view and approve student grades and absences
prepare teacher activity summary
principal
view and approve teacher activity summary

1-D List the **NON functional requirements** that you deem important for the application

ID	Description
1	Usability – response time: all functions should respond within 0,5 sec
2	Privacy – a teacher should be capable of accessing only his/her activity data. A student should be able to access only his / her data

1-e Describe below the scenario specific to a teacher who assigns a grade to a student

Precondition: student S exists, is in class C managed by teacher T for subject SJ

Postcondition: S has grade on subject SJ

Step	Description
1	T logs in
2	T selects students S in class C, for subject SJ
3	T assigns grade to S for SJ
4	T logs out
5	

2 (7 points) -Define black box tests for the following function, using equivalence classes and boundary conditions.

In a tertiary school each student is evaluated on each subject. Grades are from 1 to 10. For each subject a student can be promoted and admitted to the next term if she has at least two grades on that subject, no grade < 5, average > 5.9

The function canBePromoted receives as parameters three grades, and returns true if the student can be promoted, according to the rule expressed above. A grade 0 means ‘no grade’.

```
boolean canBePromoted(int grade1, int grade2, int grade3);
```

Examples:
canBePromoted(8,8,8) -> true
canBePromoted(0,0,8) -> false

conditions to be considered
grade1, grade2, grade3 [-maxint -1], [0, 10], [11, maxint]
no more than one zero in grades
no grade <5
average > 5.9

3 (7 points) – For the following function define the control flow graph, and define test cases to obtain the highest possible node coverage, edge coverage, multiple condition coverage, loop coverage, path coverage. For the test cases, **write only the input value**.

Write control flow graph here

```
1 int canBePromoted(int grade1, int grade2, int grade3){
2   int grades[3];
3   grades[0] = grade1;
4   grades[1] = grade2;
5   grades[2] = grade3;
6   int countZero =0; int i=0;
7   int sum =0; float average;
8   for(i =0; i<3; i++){
9      if (grades[i] ==0) countZero++;
10      sum = sum + grades[i];
11    }
12    average = sum/(3-countZero) ;
13    if (countZero >1  ||  average  <= 5.9 ) return 0;
14    return 1;
15 }
```

Coverage type	Number of test cases needed to obtain 100% coverage	Coverage obtained with test cases defined (%)	Test cases defined
Node	2	100%	
Edge	2	100%	
Multiple condition line 13	4	100%	
Loop line 8	3	Only 1/3 possible	
Path	16 (8 in for line 8 times 2 line 13)	Not all feasible, conditions in line 9 and 13 are linked	

Write test case ID (T1, T2 ..) in the rightmost column, and test cases here

4 (1 points) – In which cases an Oracle can be automatic?

If previous, reliable version of software application is available, or if function can be expressed mathematically

5 (1 point) – Describe briefly ‘mutation testing’ and its purpose

See slides

6 (1 point) — In the context of configuration management, what is the derivation history of a configuration item?

History of versions and changes to them

7 (1 point) – What is the core content of the ISO 12207 standard?

Hierarchical List of activities in the software process

8 (1 point) – Describe the ‘repository’ architectural style, its pros and cons

See slides