Bachelor Graduation Examination 2014, computer science specialization – model

1. **Algorithms and Programming** (about 60')

   Write a program in one of the programming languages Python, C++, Java, C# that:
   a. Define a class **B** with an integer attribute ***b*** and a printing method that displays the attribute ***b*** to the standard output.
   b. Define a class **D** derived from **B** with an attribte ***d*** of type string and also a method of printing on standard output that displays the attribute ***b*** of the base class and the attribute ***d***.
   c. Define a function that builds a list containing: an object $\mathbf{o_1}$ of type **B** having ***b*** equal to 8; an object $\mathbf{o_2}$ of type **D** having ***b*** equal to 5 and ***d*** equal to ″D5″; an object $\mathbf{o_3}$ of type **B** having ***b*** equal to -3; an object $\mathbf{o_4}$ of type **D** having ***b*** equal to 9 and ***d*** equal to ″D9″.
   d. Define a function that receives a List of objects of type **B** and returns a List containing only the items that satisfy the property: ***b*>6**.
   e. For data type **List** used in the program, write the specifications of the used operations.

   You can use existing libraries for data structures (Python, C++, Java, C#). It is not required to implement list operations.

2. **Databases** (about 30')

   A. Create a relational database, having all tables in 3NF, which stores the folowing information about a software company:
   - **activities**: activity code, description, activity type;
   - **employees**: employee code, name, list of activities, team where he/she belongs, team leader;

   where:
   - an **activity** is identified by "activity code";
   - an **employee** is identified by "employee code";
   - an employee belongs to only one team, and the team has a leader which is a company employee as well;
   - an employee can work on many activities, and one activity could be assigned to many employees;

   Justify that the resulting tables are in 3NF.

   B. Given the database created at point **A**, express the following queries using relational algebra **or** Select-SQL:
   i. Name of employees which are working on at least one activity of type *"Design"* and **do not** work on any activity of type *"Testing"*.
   ii. Name of employees which are team leaders of one team which has at least 10 employees.

3. Operating systems (about 30')

A. Present briefly the process states READY, RUN, WAIT and the events that cause the process to switch between them.

B. Modify the program below so that the parent process sends variable n to the child process through PIPE, and gets it back doubled. Prevent the child process from printing to the console or becoming zombie.

```
1. int main() {
2.      int n=1;
3.      if(fork() == 0) {
4.      }
5.      printf("%d\n", n);
6.      return 1;
7. }
```

C. Explain the functioning of the SH script below and the meaning of what is printed to the console. Modify the script so that the results printed on the screen, apply only to files with more than 10 lines.

```
1. N=0
2. for F in *.txt; do
3.      K=`wc -l $F|cut -d" " -f1`
4.      N=`expr $N + $K`
5. done
6. echo $N
```

Grading grid 1. Algorithmics and programming

- 1 point: Default
- 1 point component 1.a) Definition of class **B**
- 1.5 points component 1.b) Definition of class **D**
- 1.5 points component 1.c) Function definition
- 3 points component 1.d) Function definition
- 2 points component 1.e) Specifications of List operations

For each of the points detailed above, the next aspects will be considered:

- proper use of classes and objects
- proper use of list operations (compliace with specifications)
- correctness (of the subprograms)
- data encapsulation
- proper design of List operations
- suggestive names, indentation, comments if necessary.

Grading grid 2. Databases

- 1 point Default
- A: 3 points for tables in 3NF; 1 point for justification.
- B: 2.5 points for B.i; 2.5 points for B.ii.

Grading grid 3. Operating systems

- Default 1p
- Problem A 3p
- Problem B 3p
- Problem C – Functioning and result interpretation 1p
- Problem C – Code modification (execute line 4 only if K is greater than 10) 2p