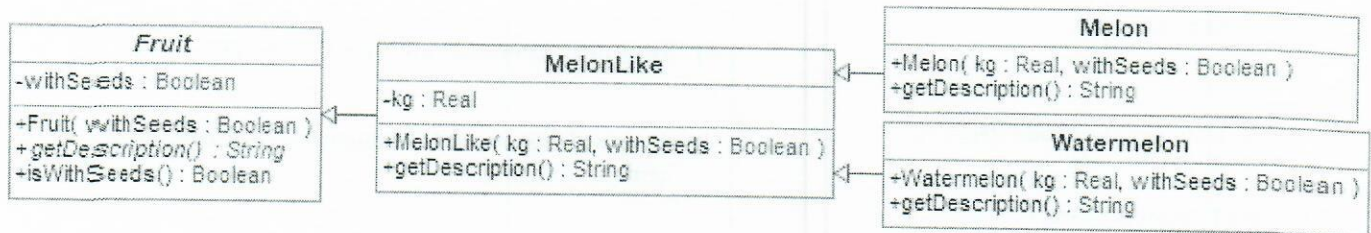


Bachelor Degree Written Exam, July 3, 2017
Computer Science – English
VARIANT 2

SUBJECT 1. Algorithms and Programming

Write a program in one of the programming languages Python, C++, Java, C# that:

a) **Defines** the classes *Fruit*, *MelonLike*, *Melon* and *Watermelon* according to the following UML class diagram:



- The *kg* must be greater than zero. The constructors must enforce the constraints.
 - The abstract class *Fruit* has an abstract method *getDescription()*.
 - The method *isWithSeeds()* from class *Fruit* returns true if the fruit is with seeds and false otherwise. The *getDescription()* method from *MelonLike* returns the string containing the kilograms, followed by “melon like”, then by “with seeds” if the object has seeds, or “without seeds” otherwise. The *getDescription()* methods from *Melon* and *Watermelon* return the description from the base class, concatenated with the text “melon”, or “watermelon” respectively.
- b) **Defines a function** that returns the position on which a given *Fruit* should be inserted into a list of *Fruit* alphabetically ordered by the values returned by the *getDescription()* method. Use a binary search algorithm.
- c) **Defines a function** that, using the function defined at b), inserts a *Fruit* into a list of *Fruit* alphabetically ordered by the values returned by the *getDescription()* method.
- d) **Defines a function** that has as parameters a boolean *withSeeds* and a list of *Fruit*, and prints the fruits from the list having the seeds/or not depending on the value of the *withSeeds* parameter.
- e) The **main function** of the program creates a list containing the following fruits: a *Watermelon* without seeds having 6 kg, a *Melon* with seeds having 10 kg, a *MelonLike* without seeds having 11 kg and a *Watermelon* with seeds having 13 kg. Using the function defined at c), insert a *Watermelon* without seeds having 12 kg in the above list. Finally, using the function defined at d) separately print the fruits with seeds and without seeds.
- (f) For the **List** data type used in the program, write the specifications of the used operations.

Remarks

- Please indicate the used programming language.
- Do not use sorted containers and predefined sorting operations.
- Do not define other methods than those required in the subject.

You can use existing libraries for data structures (Python, C++, Java, C#).

SUBJECT 2. Databases

Create a relational database with all the tables in 3NF. The database will store the following information about the TIFF event:

- **venues:** venue id, name, address;
- **movies:** title, year, a list of genres (where a genre has a genre id, name and description), a list of actors (where each actor has an id and a name) and a list of screenings for the movie (where for each screening the following information is stored: id of the screening, id of the venue, date and time);
- **sold tickets:** id of the screening, row number and seat number.

Prove that the created database is in 3NF, by identifying the functional dependencies.

- i. The list of venues (name and address) that hosted at least a screening for a *comedy* and at least one for a *drama*.
- ii. The total number of sold tickets for movies with *Alain Delon* screened in *Piața Unirii*.
- iii. The list of movies (title, year) with the largest number of sold tickets.

SUBJECT 3. Operating systems

3.1 Answer the following questions, considering that all the instructions in the code fragment below are executed successfully.

<pre> 1 int main(){ 2 int p[2], i=0; 3 char c, s[20]; 4 pipe(p); 5 if (fork()==0){ 6 close(p[1]); 7 while(read(p[0], &c, sizeof(char))){ 8 if(i < 5 i > 8){ 9 printf("%c", c); 10 } 11 i++; 12 } 13 printf("\n"); close(p[0]); 14 exit(0); 15 } 16 printf("Result: \n"); 17 strcpy(s, "exam not passed"); 18 close(p[0]); 19 write(p[1], s, strlen(s)*sizeof(char)); 20 close(p[1]); 21 wait(NULL); 22 return 0; 23 }</pre>	<ol style="list-style-type: none"> a) Sketch the hierarchy of the created processes, including the parent process. b) Give each line displayed by the program, along with the process that prints it. c) How many characters are read from the pipe? d) How will the processes' termination be affected by the removal of line 20? e) How will the processes' termination be affected by the removal of lines 20 and 21?
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3.2 Answer the following questions, considering an execution of the UNIX Shell script below.

<pre> 1 f=`find . -type f` 2 d=`find . -type d` 3 4 for x in \$f; do 5 for y in \$d; do 6 if [\$x = \$y]; then 7 echo "OK" 8 fi 9 done 10 done</pre>	<ol style="list-style-type: none"> a) How many times will „OK” be displayed? Justify your answer. b) What is the value of variable <i>f</i>? c) What is the value of variable <i>d</i>? d) What are the values of variable <i>x</i>? e) What are the values of variable <i>y</i>?
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REMARKS

- All subjects are compulsory and full solutions are requested.
- The minimum passing grade is 5,00.
- The working time is 3 hours.

Subiect 1 (Algoritmica și Programare):

Oficiu – 1p

Definirea claselor *Fruit* și *MelonLike* – 1p din care

relația de moștenire – 0.25

atribute – 0.25

constructor – 0.25

metode - 0.25

Definirea claselor *Watermelon* și *Melon* – 1p din care

relația de moștenire – 0.25

constructor – 0.25

metode – 0.5

Funcția de la punctul b) – 2p din care

signatura corectă - 0.1p

algoritmul de căutare binară - 1.8p

returnare rezultat - 0.1p

Funcția de la punctul c) - 2p din care

signatura corectă - 0.1p

determinare poziție de inserare - cu fct de la b) – 0.2p

inserarea elementului pe poziția determinată anterior – 1.7p

Funcția de la punctul d) – 1p din care

signatura corectă - 0.1p

parcurgere listă – 0.4p

verificare condiție – 0.1p

accesare și tipărire element – 0.4p

Funcția principală e) – 0.5p

f) Specificațiile operațiilor folosite pentru tipul de dată **Listă** – 1.5p**Subiect 2 (Baze de date)**

1 punct oficiu

Problema a:

2 puncte pentru tabelele în 3NF

2 puncte pentru justificare:

1 punct definiții

1 punct explicații

Problema b:

1.5 puncte pentru i

1 punct pentru ii

2.5 puncte pentru iii

Subiect 3 (Sisteme de operare):

Oficiu – 1p

3.1 – 5p din care

a) Diagrama ierarhiei - 1p

b) Linia părintelui – 0.5p

Linia fiului – 0.5p

c) 15 caractere – 1p

d) Niciun proces nu se termină. Fiul blocat la read, părintele la wait – 1p

e) Procesele se termină, pipe-ul fiind închis la terminarea părintelui – 1p

3.2 – 4p din care

a) Nu se afișează nimic – 1p

Justificare – 1p

b) Numele și calea tuturor fișierelor normale din directorul curent și toate subdirectoarele – 0.5p

c) Numele și calea tuturor directoarelor din directorul curent și toate subdirectoarele – 0.5p

d) Numele și calea fiecărui fișier lista din \$f – 0.5p

e) Numele și calea fiecărui director din lista \$d – 0.5p