Nome: _____ Nº

Exame de Recurso

Métodos de Desenvolvimento de Software
2016/2017
14 January 2017
9h00
Departamento de Informática
Universidade Nova de Lisboa
(duration 2h00)

NOTE: This test should be answered in this questions booklet and is mainly composed by multiple choice questions and open box questions. Both the multiple choice and open questions should be answered in this group of sheets (no extra sheets should be added by the student).
To select wrong answers will impact negatively in the mark of the corresponding question. On multiple choice you have to select just one answer, if wrong, it will discount in the overall grade 1/3 of the value of the correct answer.

It is not allowed to remove the staple.

If the answer sheets/booklet are not identified with a name and student number it automatically will not be considered for evaluation.

The solution can be marked using pencil or pen.

You can withdraw 45 minutes after starting the test. In a case of withdrawal, please write and sign this cover page with a statement such as: "I declare that I give up", by this informing the teacher about your decision.

After 2h00 from starting the test the teachers will collect all the answer sheets.

Rules

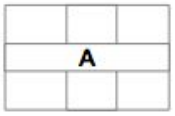
- **Duration of 2h**.
- **You can not exit during the test.**
- Can only enter during the first 30 minutes.
- Must stay 45 minutes even if intended to quit.
- No device allowed.
- Fraud attempt means to fail the course.
- Do not forget to identify with name and number your test.
- can use pencil and pen.
- Do not unstaple.
- Answer giving your best interpretation.
- Visually confusing answers will not be corrected.

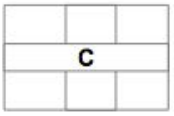
Part I - Project Management

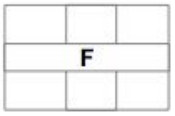
1. The table below defines the activities within a small project.

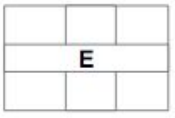
Activity	Completion time (weeks)	Immediate predecessor activities
A	2	-
B	3	-
C	4	A
D	3	B,A
E	8	D,C
F	3	C
G	2	E
H	3	F,G

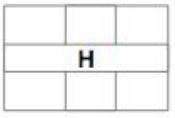
a) Complete the following Activity On Node (AON):

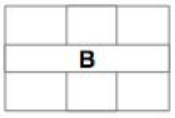


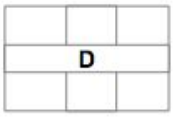


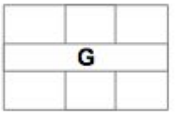












b) Identify the critical path(s) (please use the format: X->Y->Z, where X, Y and Z are hypothetical activities)

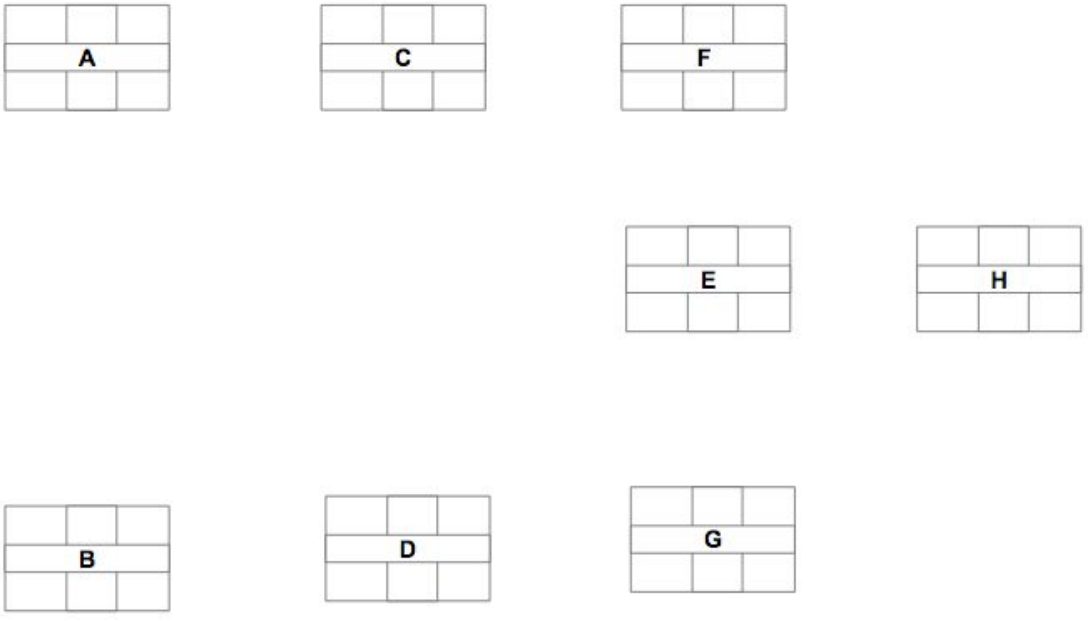
c) This project is going to take ___ days
(complete the sentence with the the exact figure).

d) Assume now that there are a number of options for the completion time for activities C, D and E as shown below:

Activity	Completion time	Cost (1.000 €)
C	4	3
	3	7
	2	10
	1	15
D	3	12
	2	16
	1	25
E	8	5
	7	9
	6	14

The rest of the activities have a cost 0.

For example choosing a completion time for activity E of 6 weeks costs 14,000 €.
Redraw the AON, updating the completion time for C, D and E so as to ensure that the project is completed within 17 weeks as an integer program.



e) In the sequence of the previous question, how much will the project cost?_____

Part II - EVM

2. Consider the following project activities, their precedence and duration:

Activity	Predecessor	Duration (days)
A		2
B	A	2
C	A	4
D	B, C	2
E	D	4
F	C	4
G	F	3
H	E, G	1

After 8 days of work, activity A has been completed on time. Three out of the 4 (similarly sized) deliverables of activity C have been completed. No other activities have started, yet. Assuming that each day's work costs €200, please compute the CV, SV the CPI and SPI for this project.

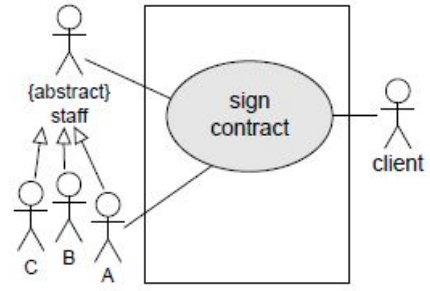
Part III - Processes and Software Development methods

3. Explain, using your own words, (and depicting the steps), what is the waterfall process? Which are its steps, advantages and disadvantages?

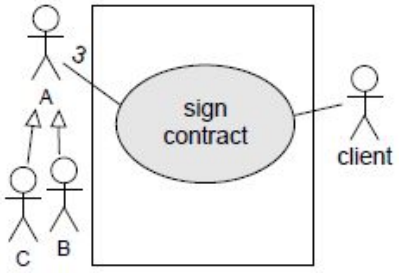
Part IV - Use Cases and Scenarios

[B1] How do you model the following situation with a UML 2 use case diagram:
"*There are 3 different types of staff members namely A, B and C. For a valid contract, the client, one staff member of Type A and two other staff members of either type (A, B or C) have to sign the contract. The possible employee combinations are: AAA, AAB, AAC, ABB, ACC, ABC*"
(choose the most **correct answer**)

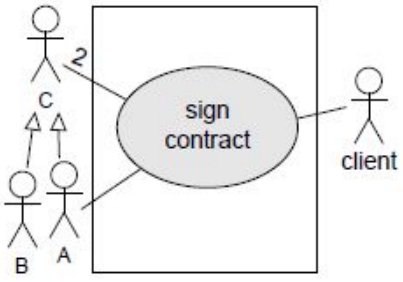
A



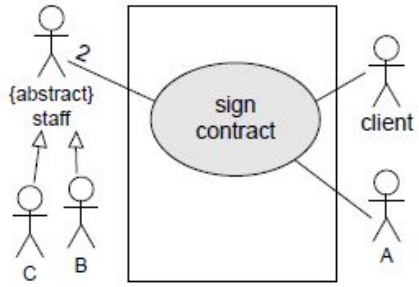
B



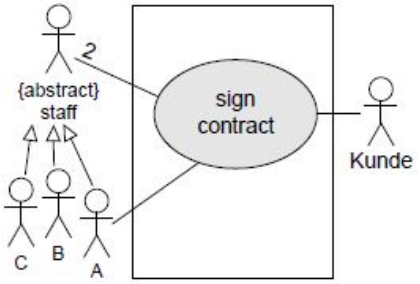
C



D



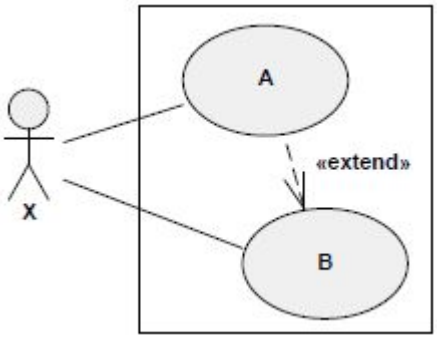
E



[B2] Actors in a use case diagram ...
(choose the incorrect answer)

A. ... can be linked to abstract and non-abstract use cases via associations.
B. ... might be used by the described system.
C. ... represent roles of the users of the described system.
D. ... are always located within the described system.
E. none of the above

[B3] The following <<extend>>-relationship means, that …



A. ... A might or might not invoke B.
B. ... A cannot be executed without B.
C. ... B can extend A.
D. ... B always has to invoke A.
E. None of the above

[B4] Consider a beverage machine. If the actor is 'customer', and the scope is 'machine', what is the scenario (Option A, Option B, Option C or Option D, or none) more likely (and more correct) to be found in the main scenario of the use case 'get drink'? Put a circle in the selected one.

Name: Get Drink
Description: A customer gets a drink from the vending machine.
Main Actors: Customer
Secondary Actors: None
Pre-condition: None
Main Scenario:

Option A
1. The use case starts when the drink is chosen
2. If drink available then show price
3. Put in coins
4. If paid enough then deliver drink
5. The Use Case Ends

Option B
1. The use case starts when the customer chooses the drink
2. The machine shows price
3. The customer puts in coins
4. The machine delivers drink
5. The Use Case Ends

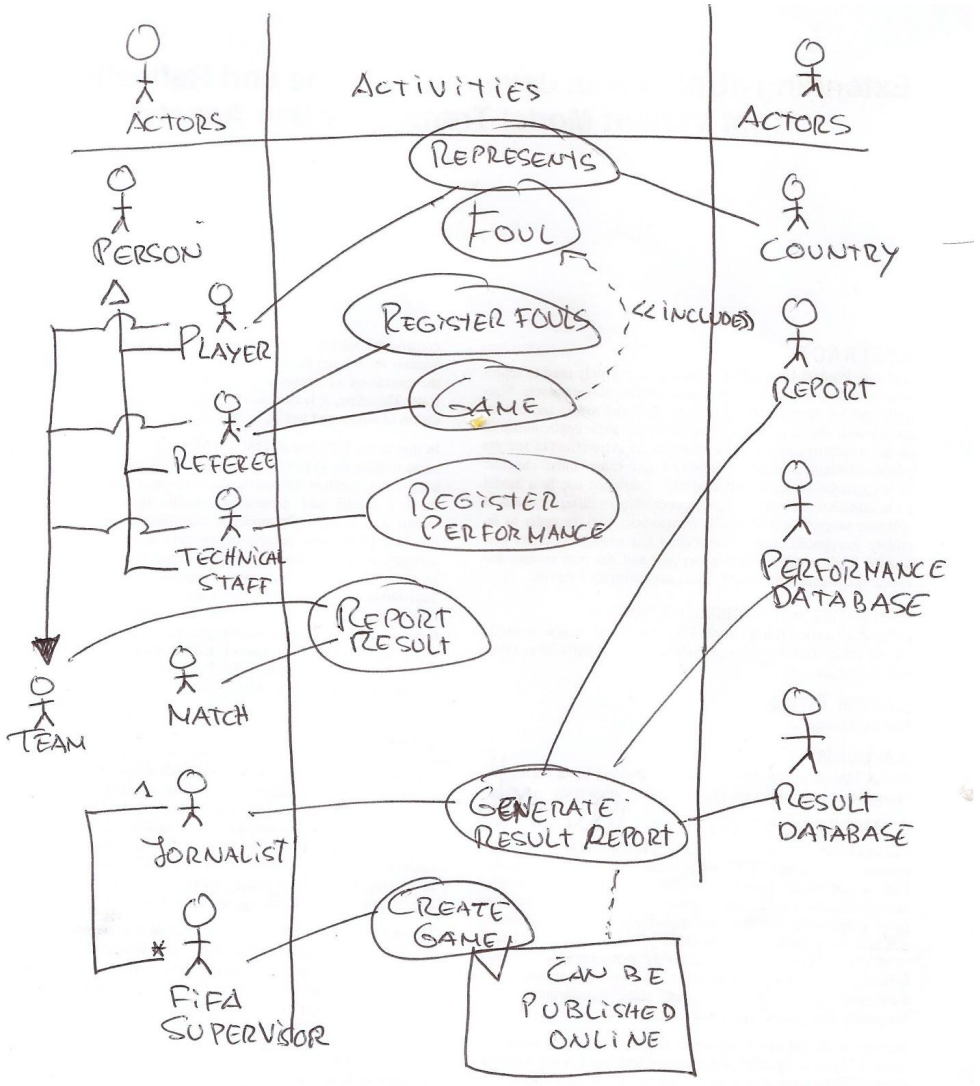
Option C
1. The use case starts when the drink is chosen
2. Shows price
3. Puts in coins
4. Delivers drink
5. The Use Case Ends

Option D
1. The use case starts when the machine sends the price to the LCD display
3. The customer put coins in slot
4. The coin mechanism verifies amount and tells machine controller
5. The machine controller activates boiler
6. The Use Case Ends

Option E
None

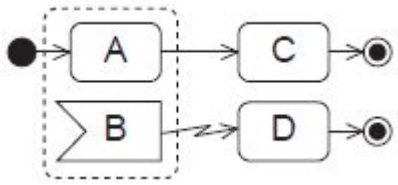
Alternative Scenarios: none
Post-conditions: none

4. Consider a system to manage the Football World Cup. The competition involves several games with teams of different countries. In each football match, the players and the technical staff represent their county. There should be in the beginning of each match a FIFA representative person who is responsible for creating the file of the game in the system. This person should also introduce the results of the game at its end. At the end of each game, one technical person of each team should register the performance details about the players. The referee should also register the fowls of the players. The systems should maintain an internal database of the performance and results, so that the journalist can generate the list of results whenever i tis necessary. Based on what described before, identify all the reasons why the diagram is incorrect. Mark in the picture the incorrections with a code label (e.g. A,B,C,...) and justify in detail each one of them in the next page.



Part V - Activity Diagrams

[B5] You are given the following activity diagram. Which of the following action sequences are possible during one execution of the activity diagram?



A. A → C → B → D
B. A → B → C→ D
C. A → B → C
D. A → B → D → C
E. None of the above

Part VI - Class Diagrams

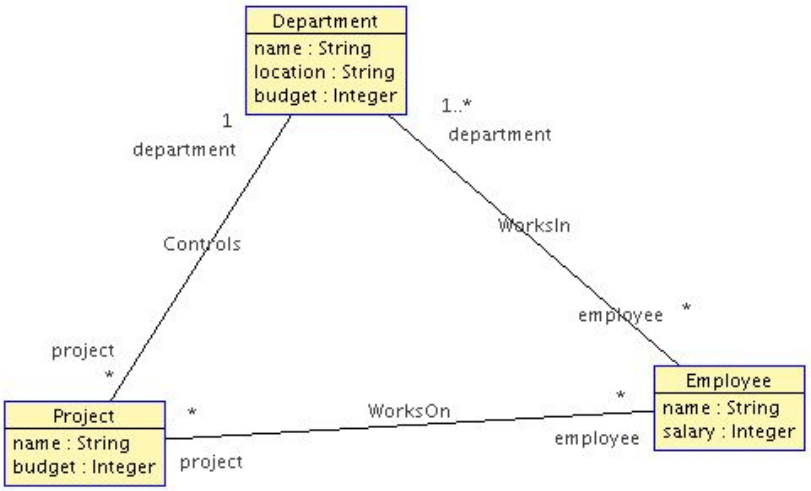
5. Model the following Domain Model (Entities) using the Class Models Notation:

“West End is responsible for booking and selling movie tickets, as well as giving more detailed information about them and allowing them to be evaluated.
A movie is shown in several movie theaters (described by name, address) in multiple sessions, from a certain date. A film has a name, production year, leading actors, director, producer, studio that produced the film and the awards he received (e.g., Oscar, Golden Lion). All movie information is provided by movie distributors, and the schedules, prices, and rooms are provided by movie theaters. Movies have a fixed entrance price.
For the system, there are two types of users, registered and unregistered. At the start all users are not registered. If you want to register, you have to fill out a form with your personal data, and the email address. In addition, you must agree to the general terms and conditions imposed by the entity that is managing the site. The unregistered user can get all information about shows and movies. The registered one can buy tickets and rate a movie. Each rating is made up of stars. For example, one star indicates that the film is bad, five stars says the film is excellent. Each time a review is submitted the average rating is re-calculated and displayed on the site for the event.

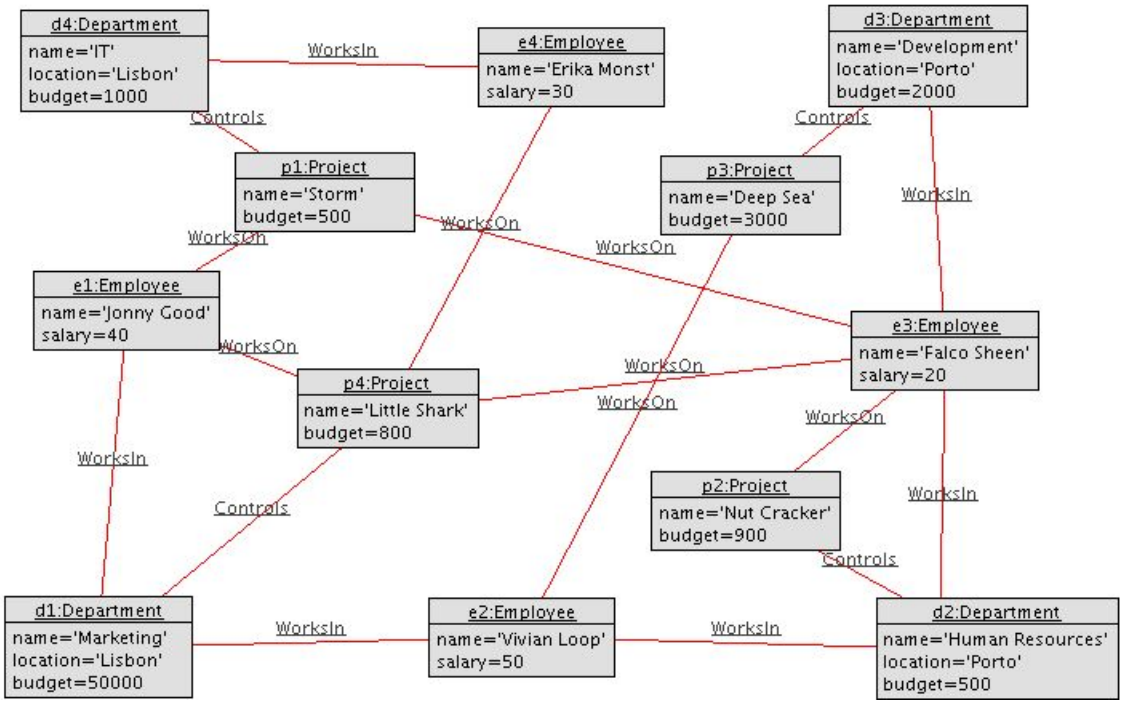
To buy a ticket the registered user must choose the movie, time, day, and the cinema where the movie will be presented. Once made the reservation, the respective payment must be made by credit card.”

Part VII - OCL

Suppose that a System Analyst, after doing a domain analysis, designs the following class diagram related to a specific company:



Consider that we have the following object diagram (instances of conformant to the previous model):



Taking into consideration the previous diagrams:

[B6] Given the following OCL expressions identify which one is true, in the context of the previous diagrams:

A. The result of evaluating “Bag{1,2,3,4,5}->iterate(number: Integer; sum:Integer = 0| sum+number)” is “15 : Integer”
B. The result of evaluating “OrderedSet{1,3,3,4,5,6}” is “OrderedSet{1,3,4,5,6} : OrderedSet(Integer)”
C. The result of evaluating “Bag{1,1,2,2,3,4,5,6}” is “Bag{1,3,3,4,5,6} : Bag(Integer)”
D. The result of evaluating “Sequence{1,1,2,2,3,4,5,6}” is “Sequence{1,1,2,2,3,4,5,6} : Sequence(Integer)”
E. None of the above

6. In the context of the previous diagram, Write OCL invariant rules that specify that If a given department has a budget greater than 3000, then it must have at least 3 projects with budget greater than 400 and must have a fully dedicated employee to that department (with no projects outside this department) with a salary greater than 100.

Part VIII - Interaction/Sequence diagrams

Consider Use Case Scenario "**Book a Hotel room**":

Name: Book a Hotel room
Description: The client inserts information to book a room at the Booking System
Actors: Client
Pre-conditions: None

Main Scenario:

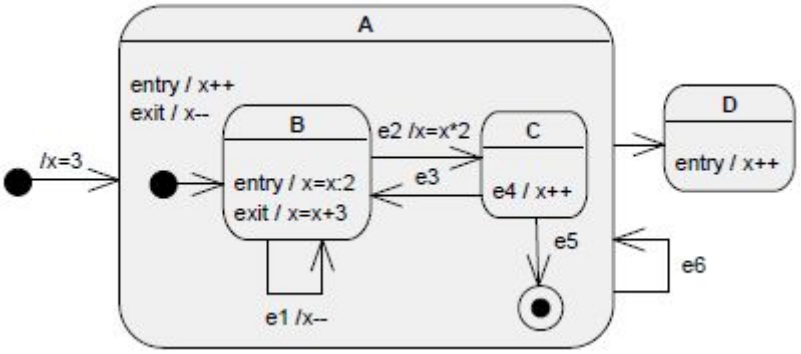
1. The Client starts by selecting the Hotel where he/she wants to reserve a room
2. The System shows the details of the Hotel
3. The Client selects the option to book a room at that given Hotel
4. The System asks to the client about his/her profile information
5. If the client has already an account
   5.1. If the client authenticates himself/herself
      5.1.1. The system uses the already stored data about the Client
   5.2. Else
      5.2.1. The client inserts his/her information
      5.2.2. The systems uses the information
6. Else
   6.1. The client inserts his/her information
   6.2. The system uses the information
7. The system asks to the Client about the entrance (check in) and departure (checkout) dates at the Hotel
8. If there are available rooms
   8.1. The system asks the client to confirm the reservation
   8.2. If the client confirms the reservation
      8.1. The system shows the details of the reservation, and end the Use Case
9. Else
   9.1. The Use Case goes back to step 7
10. The Use Case ends

Post-conditions: None

7. Design the Interaction/Sequence Diagram that represents the previous Scenario:

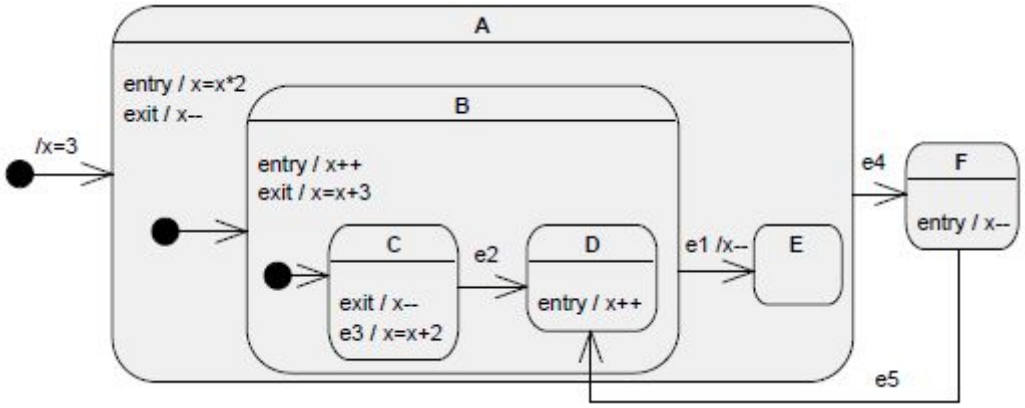
Part IX - State Charts

8. You are given the following state machine diagram. What is the value of x after the occurrence of the event chain: **e1 e2 e4 e4 e3 e1 e6**?



X=

9. You are given the following state machine diagram. What is the value of x after the occurrence of the event chain: **e3 e3 e2 e1 e4**?



X=