Software Engineering

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

Surname, name, matricola ____

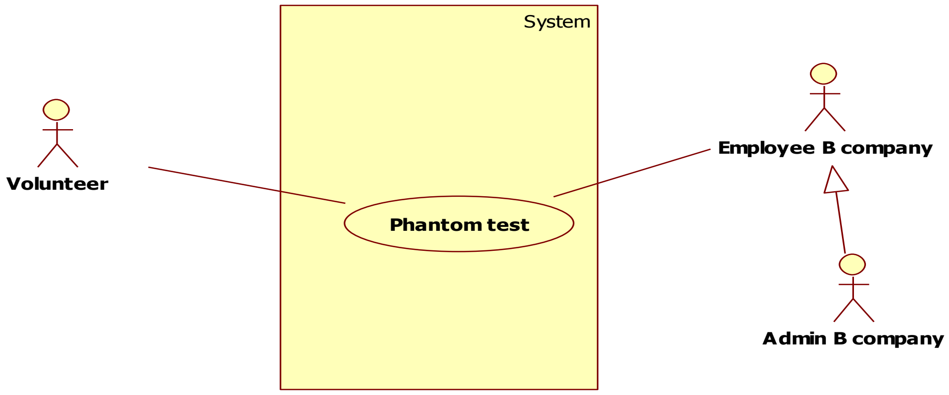
Phantom test.
Automotive companies need to verify the quality of service of workshops doing maintenance service on the vehicles. Workshops belong to companies that are independent of the automotive company, and are spread geographically. Phantom test analyzes the quality of service with special care in not making aware workshops that they are tested.

Verification of the quality of service is made as follows. Assume that the Automotive company is A. A subcontracts the verification to a specialized company B (this is important to guarantee that workshops cannot know when and how they are verified). B finds owners of vehicles manufactured by A and asks them to volunteer for the service. Volunteers are paid an amount of money. A volunteer brings its car to B, B introduces a defect in the car. Then the volunteer brings the car to a workshop for repair. After repair B inspects the car to verify the repair. Further, B interviews the volunteer about the quality of service (courtesy, cleanness, speed, price, etc).
After having collected a defined number of cases (each case is a repair of a vehicle where a defect was injected) B submits a report to A.

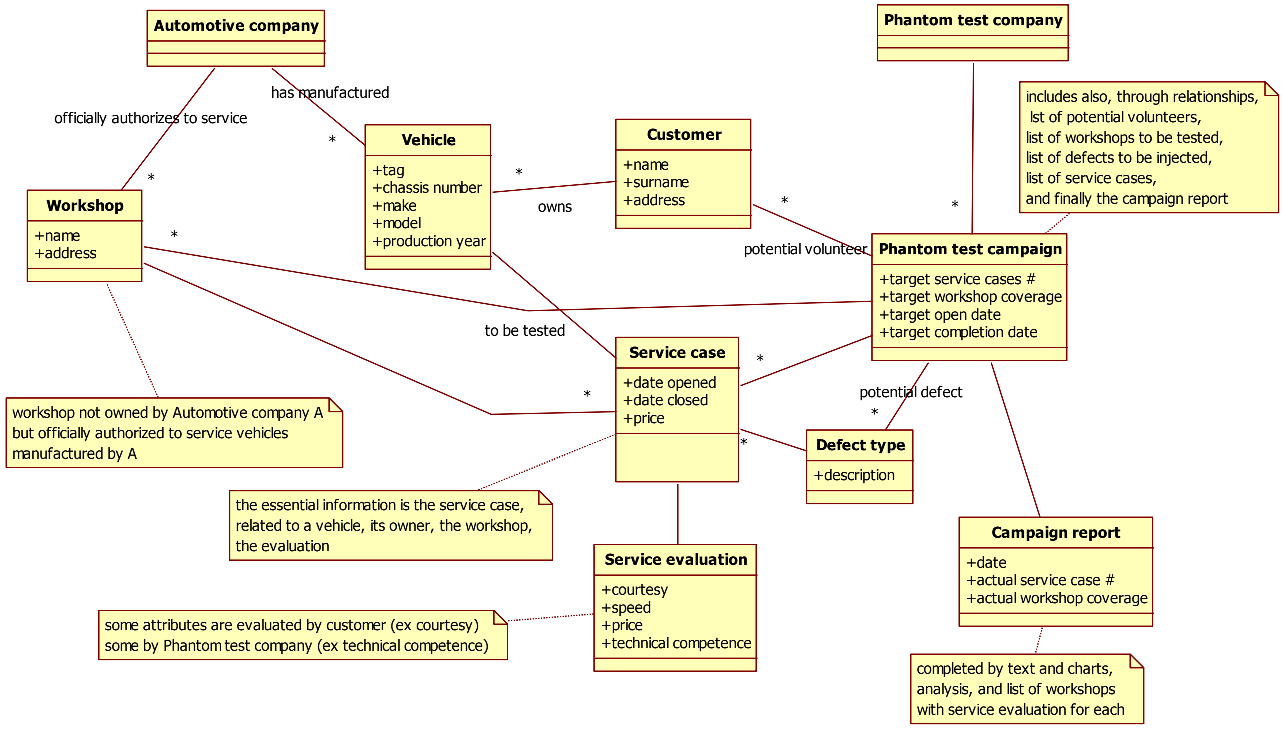
In the following consider the **software application** to support phantom testing within company B.

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

Actor	Physical interface	Logical interface
Admin company B	PC	GUI
Employee company B	PC	GUI
Volunteer	PC	GUI

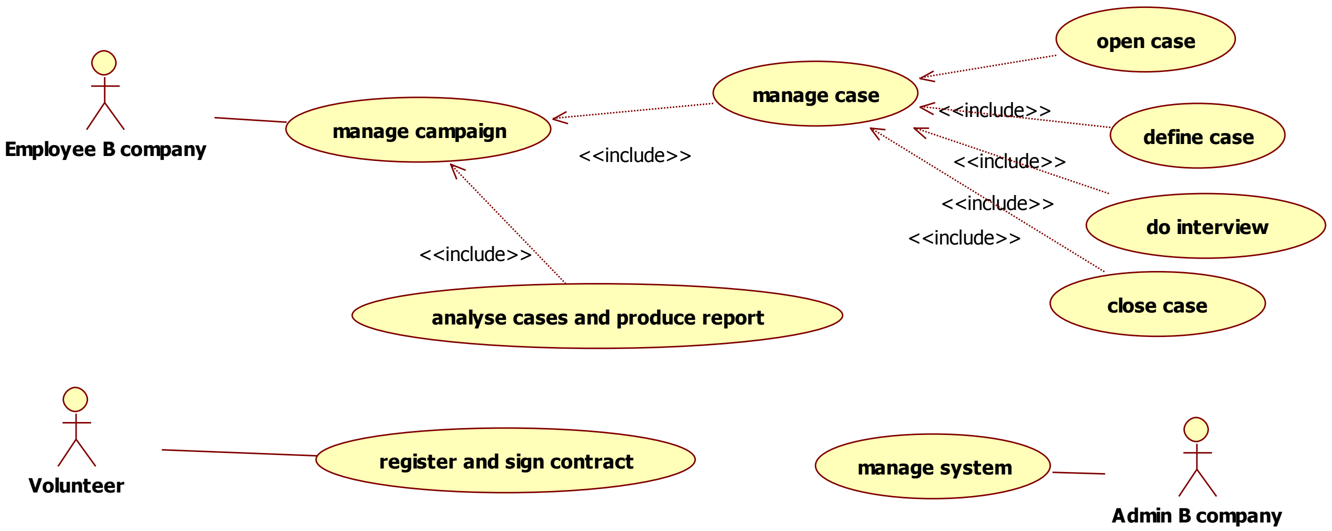


1-b Define the **glossary** (key concepts and their relationships) (UML class diagram) for the application


Automotive company
Phantom test company
officially authorizes to service
has manufactured
*
*
Vehicle
+tag
+chassis number
+make
+model
+production year
*
owns
Customer
+name
+surname
+address
*
*
includes also, through relationships,
lst of potential volunteers,
list of workshops to be tested,
list of defects to be injected,
list of service cases,
and finally the campaign report
Workshop
+name
+address
*
potential volunteer
Phantom test campaign
+target service cases #
+target workshop coverage
+target open date
+target completion date
to be tested
Service case
+date opened
+date closed
+price
*
*
potential defect
*
*
Defect type
+description
workshop not owned by Automotive company A
but officially authorized to service vehicles
manufactured by A
the essential information is the service case,
related to a vehicle, its owner, the workshop,
the evaluation
Service evaluation
+courtesy
+speed
+price
+technical competence
Campaign report
+date
+actual service case #
+actual workshop coverage
some attributes are evaluated by customer (ex courtesy)
some by Phantom test company (ex technical competence)
completed by text and charts,
analysis, and list of workshops
with service evaluation for each

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

Use Case ID	Description
Open case	Open a case
Define case	Decide car and volunteer, contact volunteer, define defect to be injected, arrange for defect injection
Do interview	Perform and record interview with volunteer
Close case	Pay volunteer, close case
Analyze cases and produce report	Do statistical analysis on all cases of campaign, draw conclusions, write report, send to automotive company
Register and sign contract	Insert personal data, agree to case and sign contract
Manage system	Define accounts, allocate privileges, monitor accesses and performance



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

ID	Description
1	Usability: all users should be able to use system after one hour training
2	Performance: response time for all functions <,5 sec
3	Privacy: data of volunteers not visible to other volunteers, data of campaign visible only to B employees

1-e Describe below the scenario specific to the handling of a volunteer after the repair of the car in a workshop

Precondition: volunteer has signed contract, case is open, defect in car has been injected and repaired by workshop

Postcondition: interview with volunteer done, related case ready for closure

Step	Description
1	Contact volunteer, agree for interview
2	Perform interview, record interview, inspect vehicle
3	Update the attached case
4	Prepare payment for volunteer
5	

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

A railway company offers the possibility to people under 15 to travel free. The offer is dedicated to groups from 2 to 5 people travelling together.

For being eligible to the offer, at least a member of the group must be at least 18 years old. If this condition applies, all the under 15 members of the group travel free, and the others pay the Base Price.

The function computeFee receives as parameters basePrice (the price of the ticket), n_passengers (the number of passengers of the group), n_over18 (the number of passengers at least 18 old), n_under15 (the number of passengers under 15 years old). It gives as output the amount that the whole group has to spend. It gives an error if groups are composed of more than 5 persons.

double computeFee(double basePrice, int n_passengers, int n_over18, int n_under15);

Examples:
computeFee(20.0, 3, 0, 1) -> 60.0;
computeFee(30.0, 5, 1, 2) -> 150.0.

basePrice	n_passengers	n_over18	n_under15	n_passengers >= n_over18 + n_under15	V/I	TC
[mindouble, 0]	*	*	*	*	I	(-10.0, 3, 1, 1) -> error B(**0**, 3, 1, 1) -> error
*	[minint, 1]	*	*	*	I	(10.0, -5, 2, 2) -> error B (10.0, **1**, 2, 2) -> error
*	*	[minint, -1]	*	*	I	(10.0, 5, -2, 2) -> error B(10.0, 5, **-1**, 2) -> error
*	*	*	[minint, -1]	*	I	(10.0, 5, 2, -2) -> error B(10.0, 5, 2, **-1**) -> error
(0, maxdouble)	[2, 5]	0	[0, 5]	no	I	(10.0, 3, 0, 4) -> error
"	"	"	"	yes	V	(10.0, 2, 0, 2) -> 2*10.0 = 20.0 B(**0.00001**, 3, 0, 2) -> 3*0.000001 B(10.0, **2**, 0, 2) -> 2*10.0 B(10.0, 3, 0, **0**) -> 3*10.0 B(10.0, **5**, 0, **5**) -> 5*10.0
"	"	[1, 5]	[0, 5]	no	I	(10.0, 2, 2, 3) -> error
"	"	"	"	yes	V	(10.0, 4, 2, 2) -> 2*10.0 = 20.0 B(10.0, 4, **1**, 2) -> 2*10.0 = 20.0 B(10.0, 5, **5**, 0) -> 5*10.0 = 50.0
*	[6, maxint]	*	*	*	I	(10.0, 7, 2, 2,) -> error B(10.0, ,2, 2) -> error
*	*	[6, maxint]	*	*	I	(10.0, 2, 7, 2) -> error B(10.0, 2, **6**, 2) -> error
*	*	*	[6, maxint]	*	I	(10.0, 2, 2, 7) -> error B(10.0, 2, 2, **6**) -> error

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 here

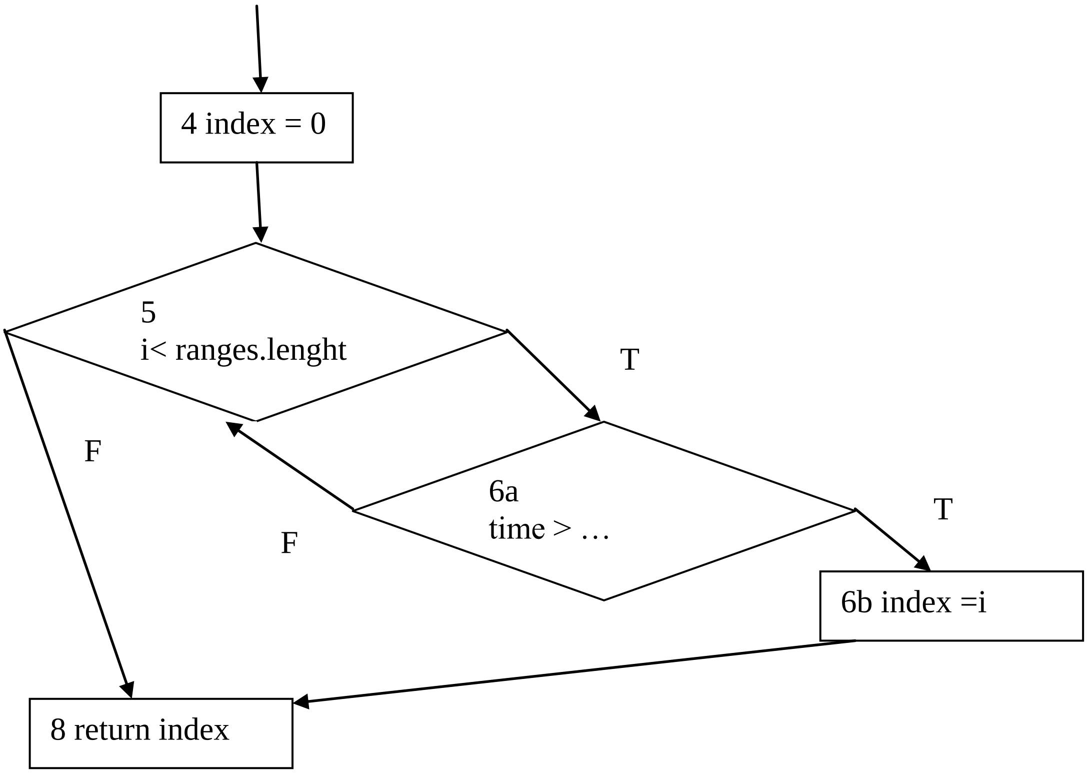
```
1     public int searchSpace(int space){
2           int[] ranges = {0, 8, 24};
3
4           int index = 0;
5           for (int i=1; i< ranges.length; i++){
6           if (space > ranges[i-1] && space < ranges[i])
7                    {index = i; break;}
8             }
9           return index;
10    }
```

Coverage type	Feasibility (Y/N)	Coverage obtained (%)	Test cases
Node	Y	100%	T(12)
Edge	Y	100%	T(12)

Multiple condition (line 6)	Y	75%
		TT
		TF
		FT
		FF
			
			T(1) or T(12)
			T(12)
			T(-6)
			Not feasible

Loop	Y	The loop is executed at maximum 2 times (== ranges.length-1). There is no way not to enter the loop, nor to loop only once (it is possible to loop once, but using the break, and not the condition within the for) 1/3 max coverage possible (2/3 considering the loop once with break)	T(12)

Path	Y	Only 3 paths are possible, so 100% path coverage is feasible:
		4 5 6a 6b 8
		4 5 6a 5 6a 6b 8
		4 5 6a 5 6a 5 8
			
			T(1)
			T(12)
			T(30), or T(-6)


4 index = 0
5
i< ranges.lenght
T
F
6a
time > …
F
T
6b index =i
8 return index

4 (1 points) – From the point of view of a user of a software application, what is more relevant, a defect or a failure in the software application? Explain why.

Failure, because user is exposed to it

5 (1 point) – Describe briefly the problem of interactions and trade offs in non-functional requirements

Some NF requirements may be in conflict (ex performance and security), so it is unfeasible to achieve both, and trade offs must be accepted

6 (1 point) — Given a software project with 4 team members, what are the risks if no configuration management is used?

Concurrent access and inconsistent modifications of CIs, unavailability of past versions of CIs

7 (1 point) – Describe the scrum process, its pros and cons.

See slides

8 (1 point) – Describe the abstract factory design pattern, and when it can be used.

See slides