

Software Engineering

Books or notes are **not** allowed.

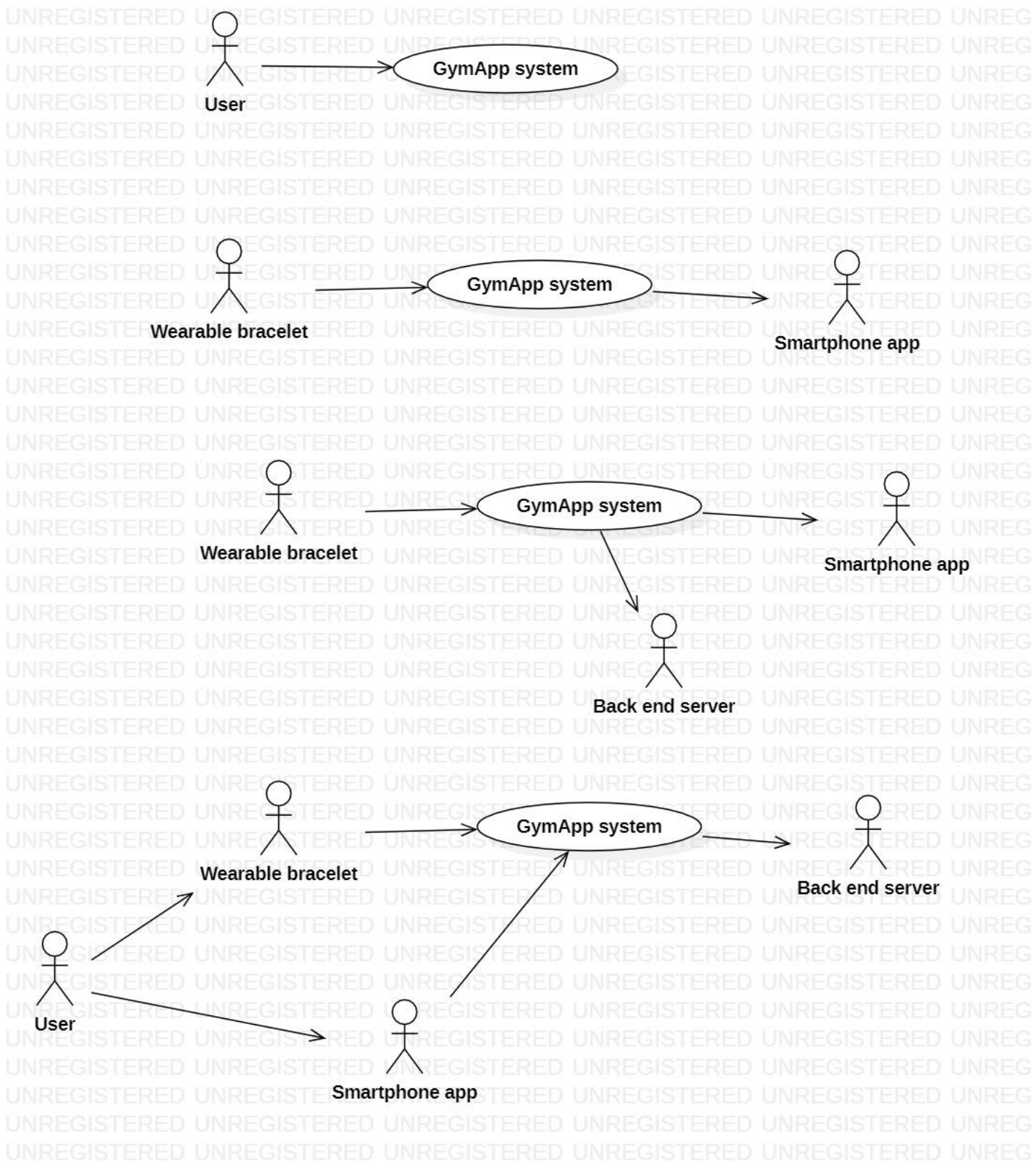
Write only on these sheets. **Concise** and **readable** answers please.

Surname, name, matricola _____

GymApp

GymApp is an ecosystem to support well being and physical activity. It is based on a wearable bracelet with sensors (laser beam + accelerometers) that collects heart rate, movement (as number of steps) and sleep duration of a person. The device has also a Bluetooth connection. Via Bluetooth the bracelet can connect to an app (available both in iOS and Android) running on the person's smartphone. The app is used to configure the bracelet and show the data collected to the user. The app also sends, via internet link, all data collected to a backend application, where the data is stored and processed. The user can access data on the server using a web browser (such as Chrome or Edge). GymApp offers functions to show in different views (daily and weekly graphs, max, min, averages) the data collected (sleep, steps, heart rate). Further, functions are available to recommend actions to the user (ex increase sleep duration, increase physical activity etc) , in function of the data collected.

In the following you should analyze the GymApp system, composed of wearable bracelet (hardware + firmware), smartphone app, backend application.



1 Select the correct context diagram

2 define the interfaces. Be consistent with the context diagram

Actor	Physical interface	Logical interface
user	Pc, smartphone	GUI
user	Laser beam, accelerometers	measure heart rate, measure steps

3 Select the correct answer (glossary)

A person makes a certain number of steps (ex 10) in a defined time interval (ex 1 minute) in a certain day.
Select the correct model corresponding to the previous statement.

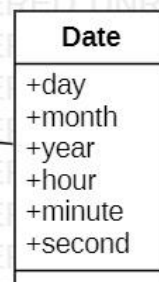
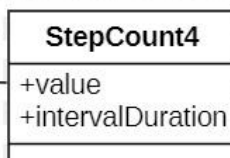
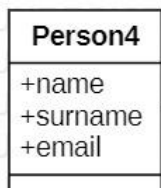
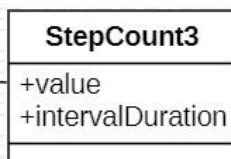
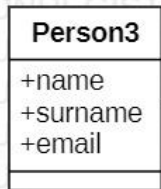
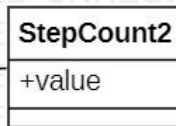
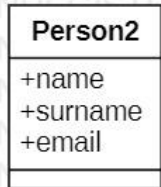
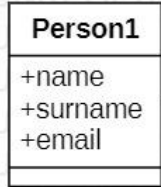
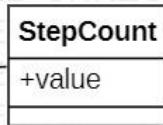
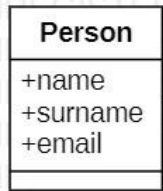
Option 5 is the most precise, allows to define the duration of the time interval and its starting point.

Option 4 conveys nearly the same information, but is redundant (duration is expressed by the two relations and by StepCount3.intervalDuration)

Option1 does not express the duration of the time interval

Option2 also, besides does not define a date as a reusable class

Option 3 constraints the duration of a time interval to be a multiple of a minute



4 Functional requirements - option 2

Select one

1 Collect and store heart rate

Collect and store sleep hours

Compute physical activity from heart rate

Show sleep hours (hours of sleep per night)

Show steps graph (steps per hour)

Show heart rate graph (heart rate during a 24h day)

2 Set up (person weight, age, height)

Pair bracelet and smartphone

Collect and store heart rate

Collect and store sleep hours

Show sleep hours (hours of sleep per night)

Show steps graph (steps per hour)

Show heart rate graph (heart rate during a 24h day)

Recommend actions

3 Show sleep hours (hours of sleep per night)

Show steps graph (steps per hour)

Show heart rate graph (heart rate during a 24h day)

Manage accelerometer sensor

Manage heart rate sensor

Compute physical activity

Recommend actions

4 Set up (person weight, age, height)

Pair bracelet and smartphone

Show sleep hours (hours of sleep per night)

Show steps graph (steps per hour)

Show heart rate graph (heart rate during a 24h day)

Recommend actions

5 NFR

Define 3 key NFR

Name	Description
Efficiency	All functions should complete in <0.5 sec
Usability	Any user with at least 12 months experience in using a smartphone should be able to use the application with no training
Privacy	A user should be able to read/write only her data

Portability	The mobile app should run on Android from 10 on, on iOS from 11 on
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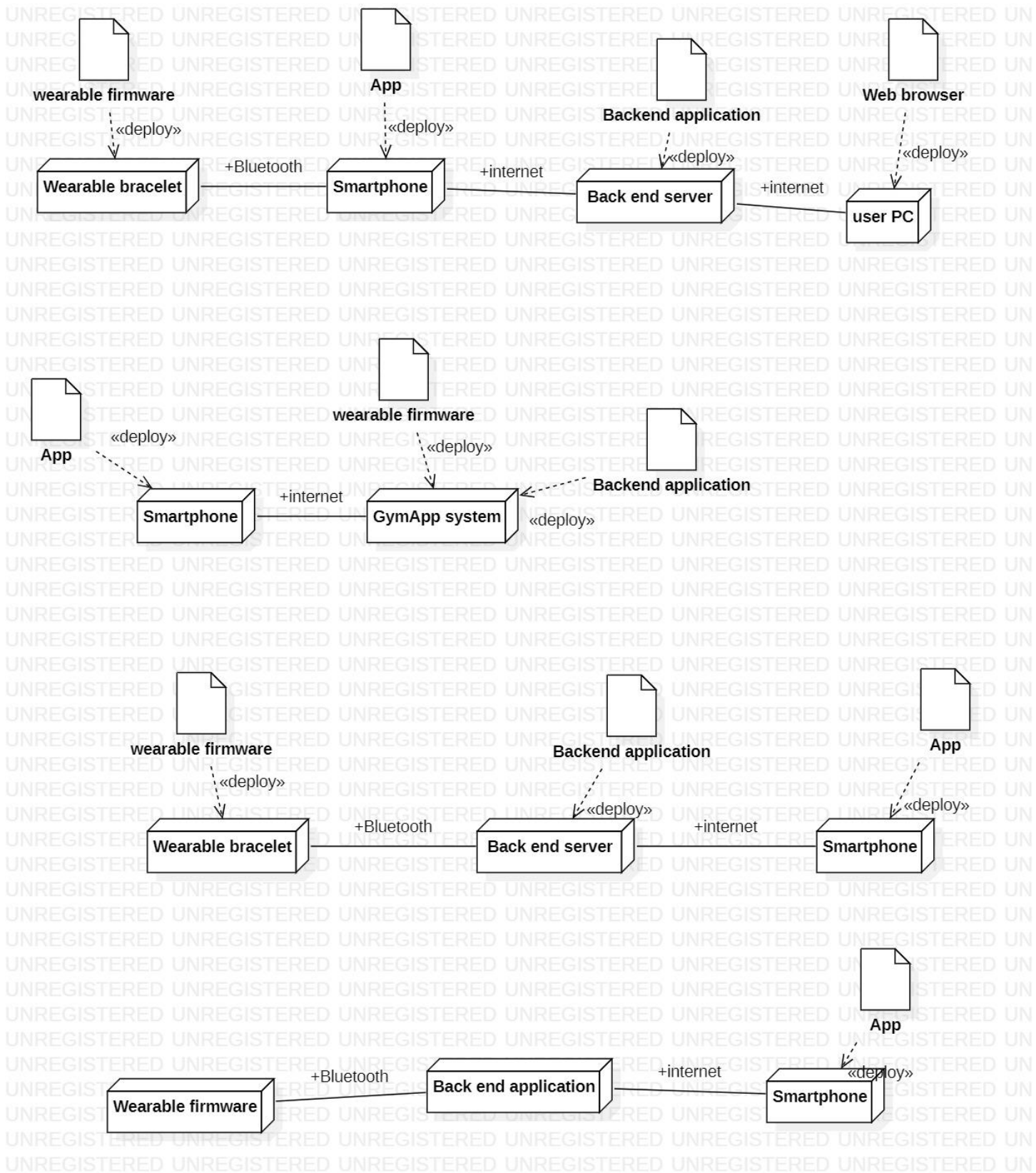
6 System design

The GymApp system is composed of:

- 1 Wearable bracelet, App (on iOS), App (on Android), backend server, web browser
- 2 Wearable bracelet, App (on iOS), App (on Android), backend application.
- 3 Wearable bracelet, App (on iOS), App (on Android), backend application, web client
- 4 Wearable bracelet, App (on iOS), App (on Android)

7 Deployment diagram

Select the correct deployment diagram - option 1



8 WB

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**.

```

1  private int compute_tax(int wage) {
2
3      int ranges[] = {5000,15000,30000};
4      int amount_due = 0;
5      int level=0;
6      boolean control = true;
7      for(int i=0;i<3;i++){
8          if(wage>ranges[i] )
9              level++;
10     }
11     if(level==1 && control == true)
12         amount_due = 500;
13     else if(level == 2)
14         amount_due = 1500;
15     else if(level == 3)
16         amount_due = 3000;
17     return amount_due;
18 }
```

Coverage type	Feasibility (Y/N)	Coverage obtained (%)	Test cases
Node	y	100	T1(6000) T2(16000) T3(35000)
Edge			T1 T2 T3 T4(500)
Multiple condition (line 11)	N Only FT TT are possible	50	T1, T2
Loop	N No way of controlling the loop, always 3 iterations	33	Any test T1, T2, T3
Path	Y Lines 7-10: in theory 2^3 paths, however only 4 are feasible (covered by T1 T2 T3 T4) Lines 11-16: in theory 2^3 paths, however only 4 are feasible (again covered by T1 to T4) Combining the cases	100	T1 T2 T3 T4

	above we have 4*4 paths, but in practice they are dependent, and only 4 are feasible overall – so path coverage is feasible		
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9 Regression testing means

- a- Testing a previous version of an application
- b- Using test suites of a previous version of an application to test a current version**
- c- Building a test suite using current and previous versions of test cases
- c- Rebuilding an application in a previous version and testing it with new test cases
- d- None of the above

10 In the context of project management a 'milestone' is

- a- a measure of completion of a project
- b- an event in a project with consequences on the evolution of the project**
- c- a measure of effort
- d- None of the above

11 A 10 person days software project can be completed in at least (one or more answers)

- a- 10 days by one person**
 - b- 1 day by 10 persons
 - c- ½ day by 20 persons
 - c- 5 days by two persons**
 - d- None of the above
- Options b and c are possible in theory, but unreasonable in practice, since it is not possible to parallelize the development among 10 people or more

12 The goal of testing is

- a- Showing that a software application works
- b- Showing that a software application is correct
- c- Finding defects in a software application**
- d- None of the above