

January the 9<sup>th</sup>, 2016

Course PA1415  
Software Design  
Third Exam

**Points**

Question 1 / 25	Question 2.1 / 10	Question 2.2 / 8	Question 3 / 27	Total / 70

**Grade**

BTH	ECTS

----- Explanations -----

### Questions.

For the multiple choice questions your task is to indicate the following statements as *true* T or *false* F by placing the appropriate letter indicator in the [ ].

For instance

[ T ] John likes Mary

indicates that the statement is true, or more precisely you think it is true.

John is

[ F ] Swedish

[ T ] English

[ F ] 5 years old

indicates the John is not Swedish, he is English and he is not 5 years old,

If you know that John is German and 20 years old, you should made the following indications:

John is

[ F ] Swedish

[ F ] English

[ F ] 5 years old

For the problem questions your answers should be written in the predefined marked places

either labelled boxes

or along labelled lines .....

Well structured answers will be appreciated.

### Marking

Every question, just after the question number, has a number of points allocated for that question.

If all entries for the question are marked correctly you obtain that number of points. For any wrong answer for the question one point is subtracted from the number of allocated points but no negative points are generated. It means that if a question has 2 points allocated and has three places to mark T or F then when you make one error you get 1 point for that question, when you make two errors you get 0 points and when all the answers are wrong you also get 0 points.

Test is worth ....70. points, 36 point is passed, 56 – very good.

### Allowed books





English – Swedish dictionary

### A remark on drawings

In the case of tasks that require producing drawings – conceptual models, state diagram, class diagram – please draw first your draft solutions on a spare paper and then redraw them on the marked area on the examination paper trying to arrange the elements (and especially connecting lines) of the picture so that the models were easy readable.

*So, good luck!*

**1. Knowledge****27 p**

1. 2 p  
Unified Development Process can be characterized that:
- is based on the WaterFall model
  - is adaptive 
  - is iterative
  - is light
2. 2 p  
Interaction Diagrams (describing interactions between objects) include:
- state diagrams
  - class diagrams
  - collaboration diagrams 
  - sequence diagrams
3. 3 p  
State Diagram
- is defined for each sequence diagram
  - is defined for a class
  - contains states, events and transitions 
  - may be structured
  - may illustrate how attributes are changed in response to events
4. 3 p  
UML Class
- is used in analysis artefacts
  - is used in design artefacts
  - may represent a concept in a domain 
  - may represent software element
  - must have attributes
  - must have operations

5. 2 p

Operation contract

defines the state of the system before starting the operation  
(when the operation is to be started)



defines the state of the system after completing the operation  
(when the operation is finished)

may define values calculated by the operation

6. 3 p

Controller is responsible for

dispatching (properly redirecting) messages coming to the system

allocating resources to collaborating objects

ensuring proper interaction with the system by actors using the system



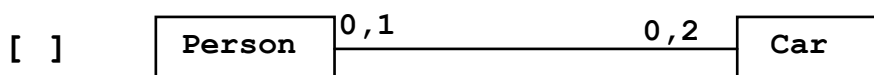
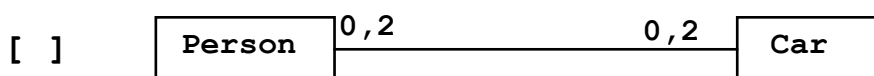
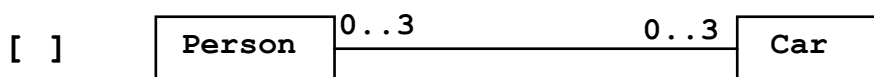
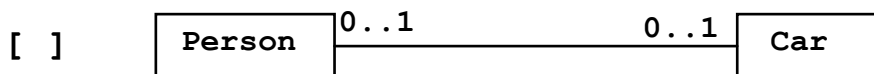
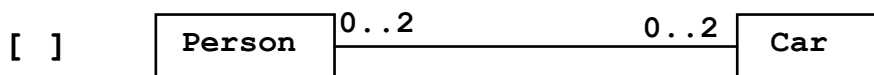
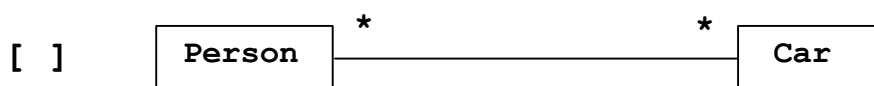
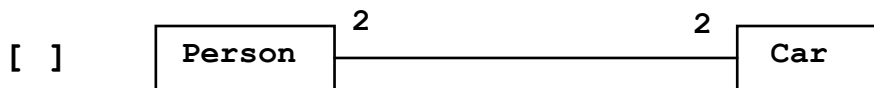
controlling the values computing during the execution of system operations

7. 5 p

Lars who is a person has two cars : Ford Focus and Opel Vectra.

Volvo Car belongs to Mary and Jane. Tom has no car.

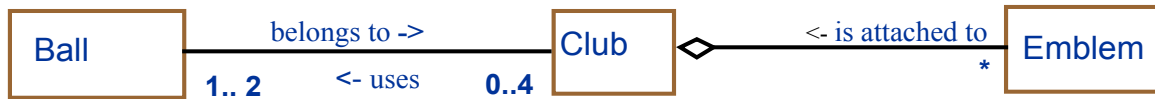
This fragment of reality conforms to (is allowed by) the conceptual model



8.

7 p

Consider a domain described by the model



Is the situation described bellow consistent with (allowed by) the above model:

- C1:Club does not use any Ball,
- There is only one Single:Emblem belonging to C2:Club,
- Common:Ball belongs to C1:Club and C2:Club,
- C3:Club has two emblems E1 and E2 attached to it,
- The Nice:Emblem can be taken from C:Club and attached to D:Club
- The number of Balls belonging to the C:Club cannot be greater than the number of Emblems attached to the same C:Club
- The number of existing Emblems can be greater than the number of existing Clubs
- The number of existing Emblems can be greater than the number of existing Balls
- The number of existing Emblems can be greater than the number of existing Clubs



**2. Object-Oriented Modelling****18 p****Modelling structure****10 p**

Draw a conceptual model for the following fragment of the problem domain.

In the Country lives a community of persons – workers and students.  
Every person has a name, personal number and address.

The address consists of the name of the town, the name of the street and the number of the apartment/flat (such as Stockholm, Vasa Street, 25).

Every person can have a number of mobile phones.

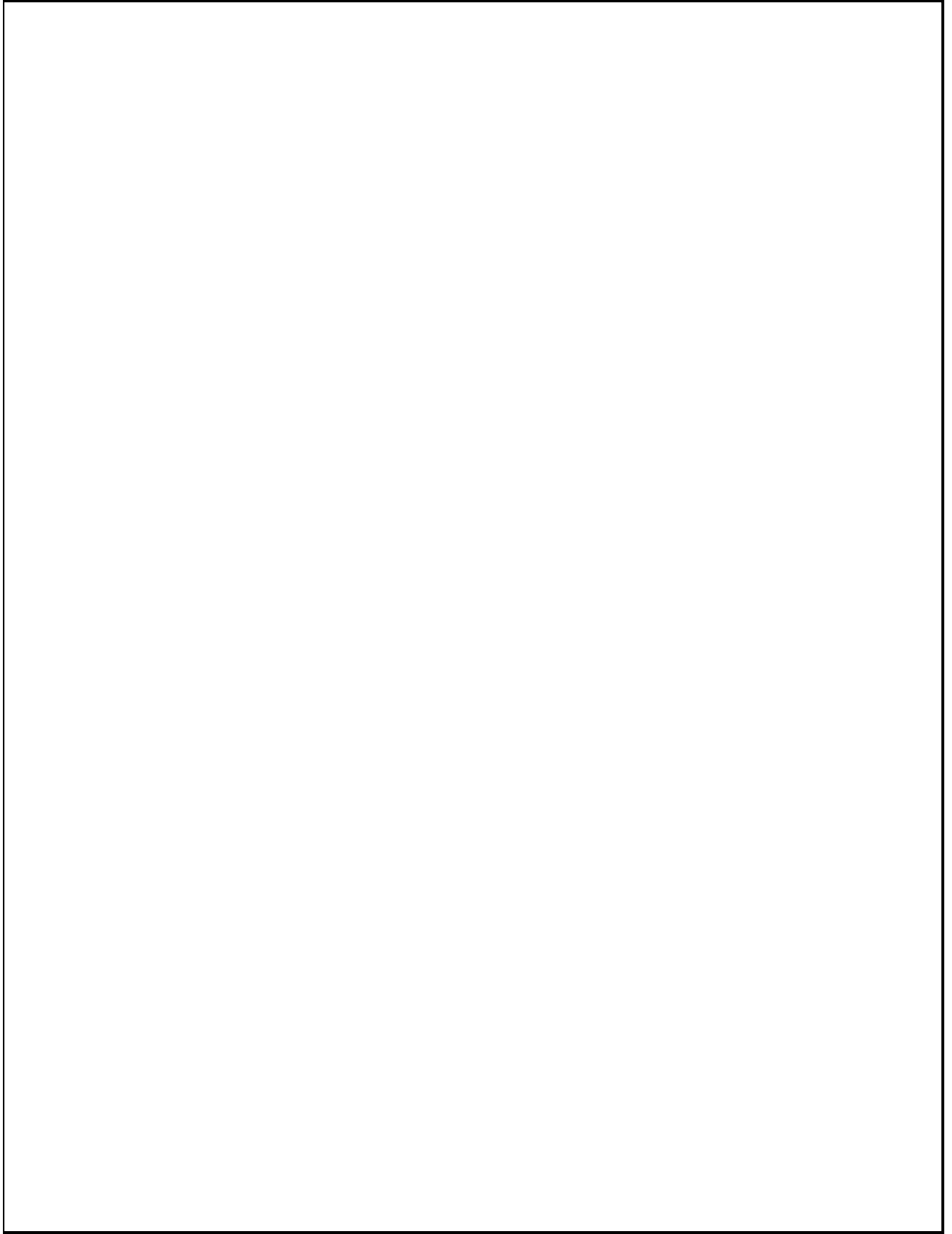
Every phone can have 1 or two phone cards. Every card has the PIN code (used to identified the legal usage of the card when the card is inserted into the phone) and the call number (the number that is used for calling).

There two types of phones – touch screen phones and  
To the keypad phones the microphone can be attached as an external device.

A person can work in a company. A person can work in no more than 4 companies, but a company may employ any number of workers.

When employed, a person gets a salary, may be different in different working places.  
The salary consists of a basic salary, extra salary and bonus.

At a given moment a person can be unemployed.



**2.1. Modelling behaviour****8 p**

A (rather very special) **Digital Watch** can display the time – hours and minutes.

When the watch is created the watch displays time - hours and minutes, and they both are set to zero.

Both the hours and minutes can be adjusted.

This is done using two buttons attached to the watch – A button and B button.

When the watch is displaying the time – steady, non-blinking hours and minutes, and the B button is pressed – nothing happens and the watch continues to display the time.

But when the A button is pressed then the watch starts to display only blinking hours and the hours can be changed by pressing the B button.

Each pressing of the button B increasing the hours by one.

Then when pressing the A button the watch starts to display only blinking minutes and then the button B can be pressed to change the minutes.

Each pressing the button B increases the minutes by one.

Then when the button A is pressed the watch starts to display the newly set time

- steady, non-blinking hours and minutes. When the button A is pressed it starts to blink hours etc

Provide an UML model describing the watch – both the structure and behaviour of the watch.





### 3. Object-Oriented Design

25 p

#### Bank Terminal

Bank Terminal is a device from which you can perform a number of operations on your bank account.

It is situated in a number of places around the town and has a direct telecommunication connection with a bank. It has a screen to display information and a number of buttons.

At the Bank Terminal you can *withdraw money* from you account.

Before you decide on how much you want in cash you *can check* how much money is available on the account. You can also make a choice on the values of the banknotes (paper money) you want the requested money be delivered – 500, 100, and 50.

The Bank Terminal will try to deliver the money as close to your request as possible.

You will not get the money if the requested amount is greater than the amount available on the account or if there is not enough money in the terminal container.

When the terminal is running out of money the terminal *maintenance office* should be notified.

At the terminal you can also make *examination* of you account. This includes a look-up of all operations preformed on the account, printing the actual balance and printing operations performed. In the last case you can make a choice what operations you want to be printed, choose the format of the printing and also choose the device on which they will be printed.

To withdraw the money and to examine your account you have to authorize.

For the *authorization* you have to insert your bank card to a special slot.

A scanner reads the card and asks you to enter PIN code. Then proceeds to the *verification* process.

During the verification process the terminal contacts with the bank, providing appropriate information about the card used for the transaction, and gets a reply if the card is valid.

Then you are asked for a code. If the code is ok you can proceed with the operations otherwise you are asked to retype the code. After three unsuccessful trials your card is kept.

The terminal contacts the bank using fibre cable connection if there is a need to obtain or to update the information about your account.

#### 3.1.1. Your tasks

- |   |     |
|---|-----|
| A. Identify actors  | 1 p |
| B. Identify Use Cases   | 2 p |
| C. Draw Use Case Diagram  | 2 p |
| D. Write extended version of WithdrawMoney Use Case<br>Use the Use Case Format introduced on the lectures | 2 p |
| E. Draw Conceptual Model  | 6 p |
| F. Identify system operations based on Use Case WithdrawMoney   | 2 p |
| G. Write a signature and contract for <b>a chosen operation</b> <sup>1</sup> from WithdrawMoney Use case  | 2 p |
| H. Draw Collaboration Diagram for the chosen operation (the one picked in p. G)                           | 3 p |
| I. Contract for the chosen (the one picked in p.G) operation  | 4 p |

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<sup>1</sup> You can pick whatever operation you want, and then use it consequently in p.H and p.I.

A. Actors

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B. Use cases

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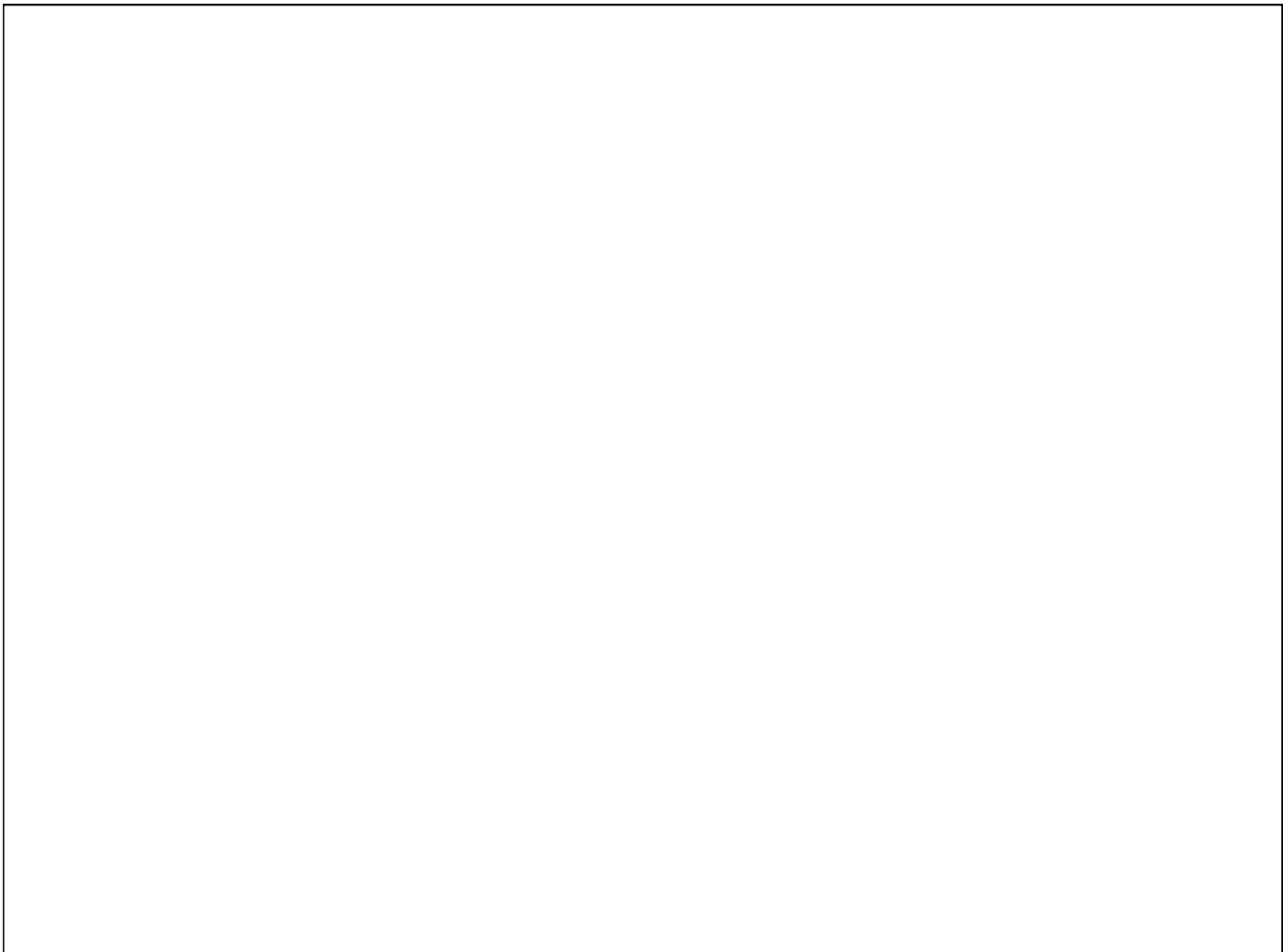
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C. Use Case Diagram





Domain Model

F. System operations

2 p

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G. Signature for the ..... system operation  
(pick one that you consider important )

2 p

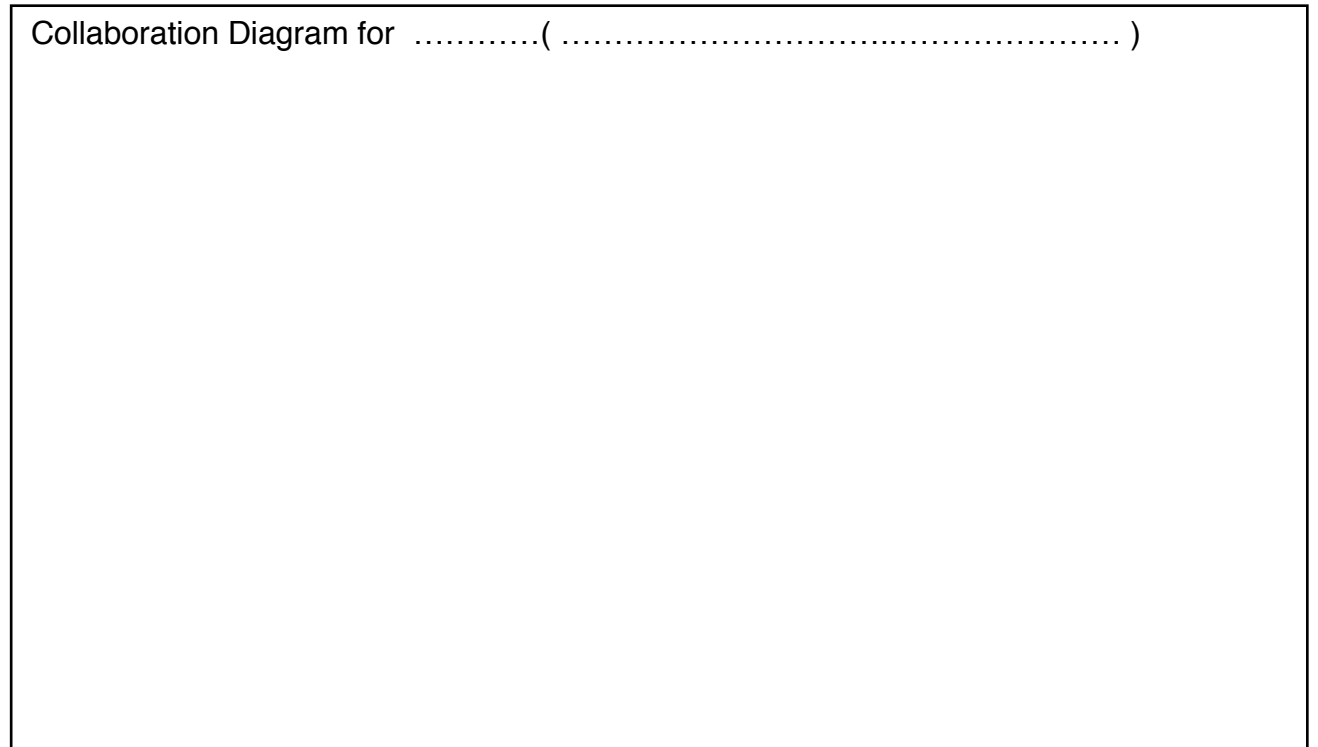
Hint.

*Signature for an operation specifies the name of the operation, arguments and returned value*

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H. Collaboration Diagram for the operation from p. G .....4 p

Collaboration Diagram for .....( ..... )



I. Contract for the ..... ( picked in p.G) operation

5 p

Text

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Stage-Curtin
