

CM10134: Programming I Coursework

Dr. Marina De Vos
Dept. of Computer Science
University of Bath
mdv@cs.bath.ac.uk

Contents

1 Introduction	1
2 Objectives	1
3 Questions	2
3.1 Question 1 (20 points)	2
3.2 Question 2 (20 points)	2
3.3 Question 3 (25 points)	2
3.4 Question 4 (35 points)	3
4 Assessment	4
4.1 Conditions	4
4.2 Estimated Workload	4
4.3 Marking	4
5 Deadline	4

1 Introduction

The goal of this coursework is to design and implement four medium-sized programs in Java. Although you can use BlueJ as a tool, we expect that the programs are fully running using JDK and the command-line.

Questions regarding the coursework can always be posted on the programming1@bath.ac.uk and tutors-programming1@cs.bath.ac.uk mailing lists.

2 Objectives

At the end of this coursework you will be able to design and write medium-sized programs containing a small number of classes by using the appropriate object-oriented software techniques of data encapsulation, inheritance and polymorphism.

3 Questions

3.1 Question 1 (20 points)

Design and implement an inheritance hierarchy to model the animal kingdom (i.e. the animal taxonomy). There is no need to implement the full taxonomy. Only that part of the taxonomy necessary to populate your hierarchy with ten different animals is required. Your sample should at least include one reptile, one mammal, one fish and one amphibian. Write a driver program that asks the user for how many animals (s)he wants in his/her zoo. Use this input to randomly create the necessary animals and store them in a container class. Write methods to allow the zookeeper to add/delete random animals and to take stock.

Answer in the comments of your driver class why asking a list of all mammals would be a breach of polymorphism. How could you solve this problem?

3.2 Question 2 (20 points)

The availability of computers with string manipulation capabilities has resulted in some rather interesting approaches to analysing the writing of great authors. Much attention has been focused on whether William Shakespeare ever lived. Some scholars believe there is substantial evidence indicating that Christopher Marlowe or other authors actually penned the masterpieces attributed to Shakespeare. Researchers have used computers to find similarities in the writings of these two authors. This exercise examines a method for analysing texts with a computer.

Write an application that runs in two modes (encoding and decoding), depending on the command-line input:

- reads several lines of text from a file and encodes the text according to the following principle:
 - a becomes 1
 - b becomes 2
 - c becomes 3
 - ...
 - after each letter 0 is inserted
 - words are to be separated by '-'

For example the string "java one" should become:
"1001022010-15014050"

Display the result of the encoding of the screen and write the result to file.

- reads in a file, supplied by the user, containing an encoding. The program should decode the file and display the result of this process on the screen.

Input of numbers, characters and multiple spaces can be ignored for your implementation.

One of the main aims and marking criteria of this question is finding a suitable algorithm for the encoding/decoding. Nested if-statements will not be highly appreciated in terms of marks. Furthermore your program will be tested for its robustness. You can use any library classes you feel appropriate.

Explain in the comments of your main class how you could extend your program to deal with the number encoding and decoding of numbers, characters and multiple spaces.

3.3 Question 3 (25 points)

Write a simulation for a phone company. The company serves two types of clients depending whether they use a mobile phone or not. When you want to make a call you ask the phone company for a connection. In return you receive a unique callID. This will be used to maintain the connection. The person called

will obtain the same callID. In order to do so the phone company will contain a collection of connections and a collection of phones. Whenever a connection is requested an object of type Connection is created containing the caller and the callee. The communication between the two parties is established by passing messages to the phone company who will pass it on the corresponding Connection for handling. Charges for the call are based on the type of phones used and the number of messages sent to a Connection. A connection can be closed by either party after which the caller is informed of the cost of the call. Make sure that you provide means to track the connections and phone calls. Provide a program that demonstrates the full capabilities of your system.

One of the main aims and marking criteria of this question is the design of your system. We will take into account the usage of abstract classes, inheritance and polymorphism. A good and robust demonstration of your program is also one of the marking criteria.

NOTE: Some of this question description is left intentionally vague to stimulate your own creativity.

HINT: Have a closer look at the LAN-simulation we have done during the lab-sessions.

DESIGN: The design of your program can be commented on by the tutors. However, this will cost you **5 marks** for this question. This should not stop you from asking general design questions. Tutors will, before answering a 5 point question, inform you about this. The choice will then be yours.

3.4 Question 4 (35 points)

Write a planning program for the following situation:

- The user inputs a city map as a text file. You can assume that your city is a grid and that the streets comprise one square while shops, banks and restaurants are composed of collection of these squares with one square as an entrance. A graphical representation of such a city can be found in Figure 1.

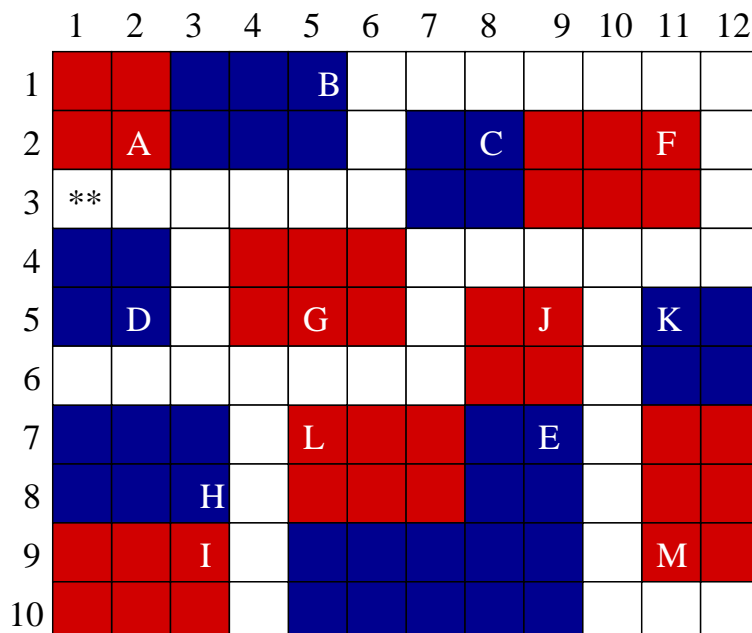


Figure 1: Grid City

- The user inputs a list of buildings (s)he needs to visit
- The user specifies a starting point

- The program returns the user a route commencing at the given starting point visiting all the requested shops, banks and restaurants.

Include with your program files a README file to explain the user how to use your system.

A complete implementation and README file of the above system will provide you more than a pass for this question. However, extra points can be obtained by:

- A graphical representation of your city
- A step-by-step graphical representation of your plan
- Instead of a single plan, make your program output all the plans in a file together with the number of street squares each of them comprises
- Provide the user with the shortest of all routes in terms of street squares that are used in the plan.

DESIGN: The design and/or algorithm used by your program can be commented on by the tutors. However, this will cost you **5 marks** for this question. This should not stop you from asking general design or implementation questions. Tutors will, before answering a 5 point question, inform you about this. The choice will then be yours.

4 Assessment

4.1 Conditions

The coursework will be conducted individually. Attention is drawn to the University rules on plagiarism on page 49 of the student handbook. There are 4 questions and you should answer all of them. You will only be entitled to marks for this coursework if you have successfully and timely completed 7 of the labs.

4.2 Estimated Workload

You need 40% to pass this part of the unit. The average amount of time you are intended to spend on this coursework is 30 hours.

4.3 Marking

The first two questions are marked out of 20, while the third is worth 25 and the fourth 35 marks. Be aware that it is almost impossible to obtain 40 from the first 2 questions. If you want to pass, you should attempt all four questions. Key issues will be: compiling, running with expected input, robustness (handling wrong user input), class and code design, proper use of inheritance and polymorphism, and the algorithms being used.

5 Deadline

The deadline for the coursework is **January 13th 2004 5pm (17.00)** Before or on the day of the deadline, hand in, at the department office, samples of input and output and a floppy/cd-rom containing the source code of each of the questions in a separate directory. Name the class with the main-method MainX with X the number of the question. Make sure that the code on the floppy is compiling and running as it should (javac *.java and java MainX from the appropriate directory). Renaming errors, wrong versions and bad disks will **not** be accepted as an excuse. It is highly advised that you also include a print-out of your code in case the electronic version of your code turns out to be faulty.