Hand out date: 23.X.2015   **Hand in date: 4.XII.2015 (Demonstration: by week 11)**

This is an assessed piece of group (of two) coursework, it is therefore essential to be completed and handed-in on time. If you are unclear about any aspect of the assignment, including the assessment criteria, please raise this at the first opportunity. The usual regulations apply to a late submission of work. The submitted application must be in Java (using Java NetBeans IDE) to be marked. During the demonstration you have to submit a disk (with your student code numbers on it) with your source code and Java NetBeans project files.

The coursework you submit should be <u>your own work</u>. If your coursework includes other people's ideas and material, they must be properly referenced or acknowledged. Failing to do so intentionally or unintentionally constitutes plagiarism. <u>The University treats plagiarism as a serious offence.</u>

ORDER SYSTEM FOR A PIPE-SELLING COMPANY

"PipesR'us" is a company producing a variety of pipes for water, drainage, fuel, gas, conduit, plumbing and heating. Due to the wide range of requirements of their customers, the variety of pipes they produce is very extensive.
The pipes are all made of plastic, but some may have metallic enforcement and other features:

- They are all made of plastic;
- Their plastic has a specified grade;
- They may have no colour (grey), 1 colour, or 2 colours;
- They may have inner insulation layer;
- They may have outer metallic reinforcement;
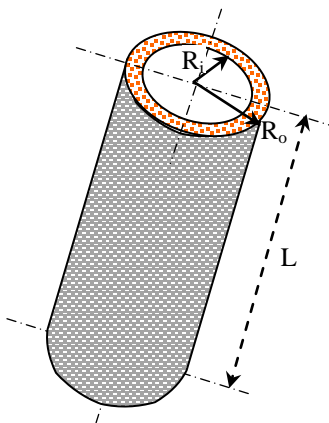- They may also have improved chemical resistance.

The types of pipes, produced by the company are shown in Table 1.

Table 1. *Types of plastic pipes available.*

Type	Plastic's grade	Colour print			Inner insulation	Outer reinforcement	Chemical resistance
		0	**1**	**2**			
I	1 – 3	YES	NO	NO	NO	NO	YES/NO
II	2 – 4	NO	YES	NO	NO	NO	YES/NO
III	2 – 5	NO	NO	YES	NO	NO	YES/NO
IV	2 – 5	NO	NO	YES	YES	NO	YES/NO
V	3 – 5	NO	NO	YES	YES	YES	YES/NO

Fig.1. Pipe's cross-section.

Pipes are available in straights (up to 6 meters). When ordering, the client should specify the length (in meters, 1m = 39.37") and the outer diameter (or outer radius R_o) – in inches (1" = 0.0254m). Assume the inner diameter (or inner radius R_i) is always 90% of the outer one. The basic cost is calculated using the volume of the pipe's material (in cubic inches) and the costs of 1 inch^3 of plastic is given in Table 2.

Table 2. *Cost of 1 cubic inch of plastic*

Grade of plastic	1	2	3	4	5
Cost per inch^3 [in £]	0.3	0.32	0.35	0.40	0.46

Table 3. *Additional costs.*

1 colour	12% extra
2 colours	17% extra
Inner insulation	14% extra
Outer reinforcement	15% extra
Chemical resistance	12% extra

There are some additional costs, depending on whether the pipe has colour and if there is any insulation and/or reinforcement. These are shown in Table 3 and the percentage increase **is based on the basic cost**.

All pipes may have improved chemical resistance. When customers ask *PipesR'us* to quote a price for an order, they specify the following features:

- The size of pipe (length in meters and outer diameter in inches);
- The plastic grade;
- Whether they want any colour. If so, whether 1 or 2 colours;
- Whether they want any insulation or/and reinforcement;
- Whether they want pipe with chemical resistance;
- The quantity of pipes for the order.

From this information, the order system should determine if the requested type of pipe can be supplied by *PipesR'us*, and if not, it should display an appropriate message and reject the order (e.g., pipe of plastic grade 1 and inner insulation is an invalid order). If the ordered pipe corresponds to one of the types given in Table 1, and can be supplied by *PipesR'us*, the cost of the pipes must be

calculated (using Table 2 and Table 3) and quoted. The customer should be able to place several orders in one session, in which case the total cost should be prompted.

Customers should not be asked for the type of pipe they want (since this is only used within the company to calculate the cost). **It is your application that must determine** (using Table 1) **the type of pipes based on the ordered pipe characteristics.**

Customers should be able to receive a quote for as many pipes (of different types) as they like (within the capacity of *PipesR'us*) in the same order. In such cases, the total cost of the order should be calculated and displayed.

Your user interface should be a GUI (graphical user interface) using AWT/Swing. If no GUI is used, you will lose the marks allocated for this part of your coursework.

Your Task

- Write an application that allows the customer to enter the details of his/her order and subsequently prompts the cost of the order. Your application should verify that *PipesR'us* can supply the corresponding to the order type of pipe (the customer should not be asked to specify the pipe type).
- Use OO design approach (polymorphism, abstraction and inheritance) and create appropriate class hierarchy, which describes the types of pipes that *PipesR'us* sells. Use of an abstract class may be an advantage.
- Give the following **UML** diagrams: one **use case;** one **class hierarchy;** one **class;** and one **instance** diagrams.
- Use appropriate encapsulation and accessibility for the class data fields and methods, and place them at an appropriate abstraction level in your OO class hierarchy design.
- Devise suitable test plan and data, which you can use to test the performance of your ordering system.

Assessment Criteria

You should give a demonstration of your software no later than week11 (4**.XII.2015**), during your lab session, and you should provide your assessor with a disk (containing your working application – Java NetBeans project files) with your student code numbers on it.
On **4.XII.2015** you should hand in (CAM office) a brief **cwk report** that includes the following:

- ✓ A UML use case diagram of your order system, UML class hierarchy diagram of your OO application design, and also one UML class diagram and one instance diagram;
- ✓ A brief description of the application including any assumptions you have made and any limitations in your implementation of the application;
- ✓ A test schedule and screen shots to evidence the testing and evaluation;
- ✓ The code you have written as an Appendix (also, during your demonstration you have to submit a disk with your source code and Java NetBeans project files);
- ✓ Some sample input and output to demonstrate your application is working;
- ✓ This document.

The assessment criteria and marks distribution are given in Table 4.

Table 4. Assessment criteria and marks distribution.

Topic/Criteria	Comments	Marks available	Marks awarded
Class hierarchy descriptions (UML)	How suitable is the design and the adopted hierarchy for the application? Use of abstract class?	10 (Report)	
UML class and instance diagrams	Are the UML use case, class and instance diagrams relevant to the application? Is the design demonstrating an OO approach?	10 (Report)	
Code and functionality	How complete is the implementation? Does it perform as specified? Does it implement an OO design approach? Use of abstract class? Are the class attributes and methods at the appropriate hierarchy level? Is the verification and validation of input data adequate? Is the exception handling properly done? Are the style, indentation and comments appropriate? Is the layout clear?	45 (Demo(20), Report(25))	
Using AWT/Swing	Is the layout clear? How well designed is the interface? How appropriate is the use of components? How appropriate is the use of attributes? Is it working, or just an attempt?	15 (Demo)	
Testing	How thorough is planning and testing? Does it cover most/few possible errors?	10 (Report)	
Supporting documentation and comments.	Is the text clearly written and well presented? Are the assumptions, limitations, problems and features of the application well documented?	10 (Report)	
OVERALL MARK		100	