

# COMP20220 Programming II (Conversion)

## Practical 2

### 1 Instructions

Create a new package named `practicalX_12345678`, where **X** is the practical number (for this week, the number is 2) and 12345678 is your student number. Save your code in this package.

Submit solutions to **questions 1, 2, and 3**. Create a new class for each question and name the classes as follows: `Q1.java`, `Q2.java`, and `Q3.java`.

Upload your solutions to Moodle:

- Right-click on the package name and select *Export*. A dialogue box will appear – select *Next*.
- You will then be asked to specify the name of the archive file which will be created – use the following naming convention: `practicalX_12345678.zip`, where **X** is the practical number and 12345678 is your student number. Select *Finish*.
- Upload the zip file using the link on Moodle.

The submission deadline is **5pm Tuesday, 6th February**. Please note this is a firm deadline – model solutions will be released on Moodle at this time.

## 2 Questions

**Q1** The two roots of a quadratic equation  $ax^2 + bx + c = 0$  can be obtained using the following formula:

$$r_1 = \frac{-b + \sqrt{b^2 - 4ac}}{2a} \quad \text{and} \quad r_2 = \frac{-b - \sqrt{b^2 - 4ac}}{2a},$$

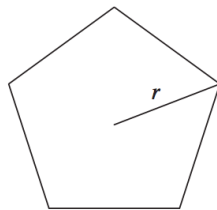
where  $b^2 - 4ac$  is called the discriminant of the quadratic equation. If it is positive, the equation has two real roots. If it is zero, the equation has one root. If it is negative, the equation has no real roots.

Write a program that prompts the user to enter values for  $a$ ,  $b$ , and  $c$  and displays the result based on the discriminant. If the discriminant is positive, display two roots. If the discriminant is zero, display one root. Otherwise, display “The equation has no real roots”. Note – the value of  $a$  must be non-zero and your program should first test this condition and exit with an appropriate message if it is not true.

**Q2** Write a program that reads the lengths of the three sides of a triangle and computes the perimeter if the input is valid. Otherwise, display that the input is invalid. The input is valid if the sum of every pair of the lengths of two sides is greater than the length of the remaining side.

**Q3** Write a program that prompts the user to enter an integer between 0 and 15, inclusive. Check if the input is valid and if so, display its corresponding hex number.

**Q4** Write a program that prompts the user to enter the length from the center of a pentagon to a vertex and computes the area of the pentagon, as shown in the following figure.



The formula for computing the area of a pentagon is:

$$\text{area} = \frac{5s^2}{4 \tan(\pi/5)},$$

where  $s$  is the length of a side. The side can be computed using the formula  $s = 2r \sin(\pi/5)$ , where  $r$  is the length from the center of a pentagon to a vertex. Check that the value entered by the user is valid (i.e.  $> 0$ ) and if not, display a suitable message to the user.

**Q5** Write a program that prompts the user to enter a point  $(x, y)$  and checks whether the point is inside or on the edge of the rectangle centered at  $(0, 0)$  with width 10 and height 5. For example, point  $(2, 2)$  is inside the rectangle and point  $(6, 4)$  is outside the rectangle, as shown in Figure 1.

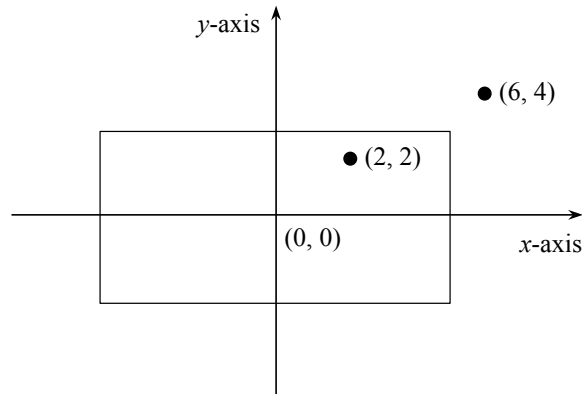


Figure 1: Points inside and outside of the rectangle.

**Q6** Write a program that (a) reads a Unicode value (an integer between 0 and 65,535 inclusive, check that the user inputs a valid code) and displays its character and (b) reads a character and displays its Unicode value (in decimal).

Note – use the following code to read a character from the keyboard:

```
Scanner input = new Scanner(System.in);
System.out.print("Enter a character: ");
char ch = input.next().charAt(0);
```

**Q7** Write a program that prompts the user to enter a lowercase or uppercase letter. Check if the input is valid and if so, check whether the letter is a vowel or consonant.

**Q8** Using a `switch` statement, write a program that prompts the user to enter a year and the first three letters of a month name (with the first letter in uppercase) and displays the number of days in the month. If the month entered is `Feb`, the program should check if the year entered is a leap year and output 28 or 29 days as appropriate. Rewrite the program using an `if-else` statement.

Note – use the following code to read an integer and a string from the keyboard:

```
Scanner input = new Scanner(System.in);
System.out.print("Enter a year: ");
int year = input.nextInt();
System.out.print("Enter a month (e.g. Jan, Feb, etc.): ");
String month = input.next();
```