Tshwane University of Technology

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Principles of Programming A (Extended) (PPAF05D)

Introduction to Programming 115R (TROF05D)

Unit 5

Iteration control structures in Java

Solutions to activities

Activity 1:   Repeat the same calculations

```java
package allstudcalcpercwithcounter;
import java.util.Scanner;
public class AllStudCalcPercWithCounter {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        char cAnswer;
        double rScore;        //The mark the student scored
        int iTestTotal;   //The total marks for the test
        double rPerc;         //The percentage the learner obtained
        int iCounter = 0;     //To count the number of marks processed

        System.out.print("What is the total for the test?: ");
        iTestTotal = keyboard.nextInt();
        System.out.print("Do you want to enter a mark for a test? <Y>/<N> (a mark is out
of " + iTestTotal  + ") ");
        cAnswer = Character.toUpperCase(keyboard.next().charAt(0));

        while (cAnswer == 'Y')
        { //begin while
                iCounter++;
                System.out.print("What is the score? ");
                rScore= keyboard.nextDouble();
                rPerc = Math.round(rScore / iTestTotal  * 100);
                System.out.println("The percentage is : " + rPerc + "%");
                System.out.print("Do you want to enter a mark for a test? <Y>/<N> (a
mark is out of " + iTestTotal  + ") ");
                cAnswer = Character.toUpperCase(keyboard.next().charAt(0));
        } //end while

        System.out.println("You are done calculating percentages.");
        System.out.println("You processed " + iCounter + " marks");

    }
}
```

Activity 2:   Use a while loop to prevent errors

Activity 2a)

```java
package couriercostwhile;
import java.util.Scanner;
```

```java
import java.text.DecimalFormat;
public class CourierCostWhile {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        DecimalFormat formatter = new DecimalFormat("R,###.00");

        final int VAT = 15, INSURE_PERC = 11;
        final double PERKG = 5.5, ROAD = 0.8, TRAIN = 0.5, AIR = 1.5;
        double rMass, rKM, rTotal, rTransp = 0;
        char cTransp, cInsure;

        //input
        System.out.print("Number of kg to transport: \t\t\t");
        rMass = keyboard.nextDouble();
        System.out.print("Number of km : \t\t\t\t\t");
        rKM = keyboard.nextDouble();
        System.out.print("Is transport by <R>oad, <T>rain or <A>ir \t");
        cTransp = Character.toUpperCase(keyboard.next().charAt(0));
        while (cTransp != 'R' && cTransp != 'T' && cTransp != 'A')
        {
            System.out.println("You need to enter either R, T or A");
            System.out.print("Is transport by <R>oad, <T>rain or <A>ir \t");
            cTransp = Character.toUpperCase(keyboard.next().charAt(0));
        }

        System.out.print("Insurance <Y>es or <N>o \t\t\t");
        cInsure = Character.toUpperCase(keyboard.next().charAt(0));
        while (cInsure != 'Y' && cInsure != 'N')
        {
            System.out.println("You need to enter either Y or N");
            System.out.print("Insurance <Y>es or <N>o \t\t\t");
            cInsure = Character.toUpperCase(keyboard.next().charAt(0));
        }
        //set the transport cost based on the mode of travel
        switch (cTransp)
        {
            case 'R': rTransp = ROAD; break;
            case 'T': rTransp = TRAIN; break;
            case 'A': rTransp = AIR;
        }
```

```
        //calculate the cost based on the mass and the distance
        rTotal = rMass * PERKG + rTransp * rKM;
        //add insurance cost if chosen
        if (cInsure == 'Y')
        {
            rTotal = rTotal + INSURE_PERC/100.0 * rTotal;
            System.out.println("Adding insurance");
        }
        //Add VAT to the total
        rTotal = rTotal + VAT/100 * rTotal;
        //output
        System.out.println("You need to pay: \t\t\t\t" + formatter.format(rTotal));
    }
}
```

```
package cashier;
import java.util.Scanner;
import java.text.DecimalFormat;
public class Cashier {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        DecimalFormat formatter = new DecimalFormat("R,##0.00");
        double rSpent, rAmtDue, rChange, rPaid;
        final double VAT = 0.15;

        System.out.print("Amount for all items the customer bought: R");
        rSpent = keyboard.nextDouble();
        rAmtDue = rSpent + rSpent * VAT;
        System.out.println("Customer should pay " + formatter.format(rAmtDue));

        System.out.print("Amount customer handed to cashier: R");
        rPaid = keyboard.nextDouble();
        while (rPaid < rAmtDue)
        {
            System.out.println("It is not enough money - enter the amount again.");
            System.out.print("Amount customer handed to cashier: R");
            rPaid = keyboard.nextDouble();
        }
```

```
        rChange = rPaid - rAmtDue;
        System.out.println("Customer must receive " + formatter.format(rChange) + "
change.");
    }
}
```
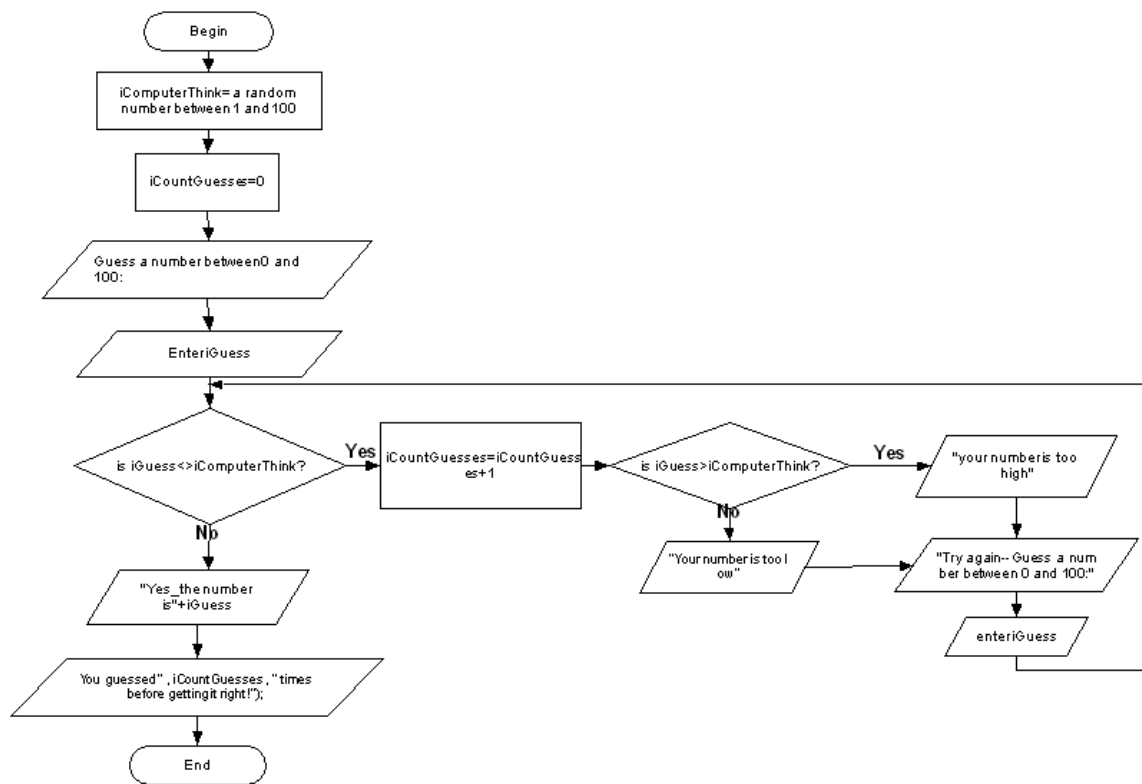
Activity 3:   While loop terminologies

Write down the term for each of the following descriptions:

a.	The variable(s) used in the condition of a loop to determine whether the statements in the body of the loop should be executed.	Loop control variable
b.	The statements that will be executed when the loop continuation condition is true.	Body of the loop.
c.	A loop that will not terminate because the loop continuation condition never becomes false.	Infinite loop.
d.	The principle that should be applied to ensure that a while loop will execute and terminate correctly.	Initialize Test Change (ITC)
e.	The combination of characters you need to press while running a program where a loop cannot terminate.	<ctrl> <Z>

Activity 4:   Flow chart for guessing game

```
                      ┌──────────────┐
                      │    Begin     │
                      └──────────────┘
                             │
                             ▼
              ┌────────────────────────────┐
              │  iComputerThink= a random  │
              │  number between 1 and 100  │
              └────────────────────────────┘
                             │
                             ▼
              ┌────────────────────────────┐
              │      iCountGuesses=0        │
              └────────────────────────────┘
                             │
                             ▼
            ╱────────────────────────────────╱
           ╱  Guess a number between 0 and  ╱
          ╱   100:                         ╱
         ╱────────────────────────────────╱
                             │
                             ▼
            ╱────────────────────────────────╱
           ╱        EnteriGuess             ╱
          ╱────────────────────────────────╱
                             │
                             ▼
```

is iGuess<>iComputerThink?   **Yes** → iCountGuesses=iCountGuesses+1   →   is iGuess>iComputerThink?   **Yes** →   "your number is too high"

No

"Yes_the number is"+iGuess

No → "Your number is too low"

→ "Try again-- Guess a number between 0 and 100:"

→ enteriGuess

You guessed" , iCountGuesses , " times before getting it right!");

```
                      ┌──────────────┐
                      │     End      │
                      └──────────────┘
```

Activity 5: Small games

Activity 5a)

```
package rolldicesum7;
import java.util.Random;
public class RollDiceSum7 {
    public static void main(String[] args) {
        Random rand = new Random();

        int iDie1, iDie2, iSum, iCount = 1;

        System.out.println ("Here I start rolling.");
        iDie1 = rand.nextInt(6) + 1;
        iDie2 = rand.nextInt(6) + 1;
        iSum = iDie1 + iDie2;
        while (iSum != 7)
        {
            System.out.println (iDie1 + " + " + iDie2 + " = " + iSum);
            iDie1 = rand.nextInt(6) + 1;
            iDie2 = rand.nextInt(6) + 1;
            iCount ++;
            iSum = iDie1 + iDie2;
        }

        System.out.println (iDie1 + " + " + iDie2 + " = " + iSum);
        System.out.println ("All done - I had to roll the dice " + iCount + " times.");
    }
}
```

```
package rolldicedouble6;
import java.util.Random;
public class RollDiceDouble6 {
    public static void main(String[] args) {
        Random rand = new Random();

        int iDie1, iDie2, iCountThrows = 0;

        System.out.println ("Here I start rolling.");
        iDie1 = rand.nextInt(6) + 1;
        iDie2 = rand.nextInt(6) + 1;

        while ((iDie1!=6) || (iDie2!=6))
        {
            iCountThrows ++;
            System.out.println ("I threw " + iDie1 + " and " + iDie2);
            iDie1 = rand.nextInt(6) + 1; //nextInt() method can generate 6 different
numbers - a number between 0 and 5 - therefore you need to add 1
            iDie2 = rand.nextInt(6) + 1;
        }
        iCountThrows ++; //To count the last time the dice were rolled and both were
sixes
        System.out.println ("The last throw was " + iDie1 + " and " + iDie2);
        System.out.println ("I had to roll the dice " + iCountThrows + " times to get
two sixes.");
    }
}
```

Activity 6: Repeat the same calculations a set number of times

Activity 6a)

```java
package calctsa;
import java.util.Scanner;
public class CalcTSA {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);

        int iNumSurfaces, iCounter = 0;
        double rTSA = 0, rWidth, rLength, rArea;

        System.out.print("How many rectangle surfaces does the object have?: ");
        iNumSurfaces = keyboard.nextInt();
        while (iCounter < iNumSurfaces)
        {
                iCounter++;
                System.out.print("Enter length of rectangle " + iCounter + ": ");
                rLength = keyboard.nextDouble();
                System.out.print("Enter width of rectangle " + iCounter + ": ");
                rWidth = keyboard.nextDouble();
                rArea = rLength * rWidth;
                rTSA += rArea;
        }

        System.out.println("Total surface area is: " + rTSA);
    }
}
```

Act 6 b)

```java
package subtractquiz;
import java.util.Scanner;
public class SubtractQuiz {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);


        int iFirstVal, iSecValue, iCorrectAnsw, iUserAnsw, iTotalCorrect = 0, iCountQ =
0;
        final int NUMQ = 4;


        while (iCountQ < NUMQ)
        {
            iCountQ++;
            iFirstVal = (int) (Math.random() * 10);
            iSecValue = (int) (Math.random() * 10);
            iCorrectAnsw = iFirstVal - iSecValue;
            System.out.println("This is question number " + iCountQ);
            System.out.print("What is " + iFirstVal + " - " + iSecValue + "? ");
            iUserAnsw = keyboard.nextInt();
            if (iUserAnsw == iCorrectAnsw)
            {
                iTotalCorrect++;
                System.out.println("Correct!");
            }
            else System.out.println("No! " + iFirstVal + " - " + iSecValue + " = " +
iCorrectAnsw);
        }

        System.out.print("You had " + iTotalCorrect + " correct answers.");
    }
}
```

```java
package weightloss;
import java.util.Scanner;
public class WeightLoss {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        int iCountMembers = 0, iTotNumGain = 0, iTotNumLost = 0, iSame;
        double rStartWeight, rEndWeight, rDiff ;
        String sName;

        System.out.print("Enter name (zzz to stop): ");
        sName = keyboard.nextLine();


        while (!sName.equalsIgnoreCase("zzz"))
        {
            iCountMembers++;
            System.out.print("\nStart weight for " + sName + ": ");
            rStartWeight = keyboard.nextDouble();
            System.out.print("End weight for " + sName + ": ");
            rEndWeight = keyboard.nextDouble();
            keyboard.nextLine(); //clear keyboard buffer
            rDiff = rEndWeight - rStartWeight;
            if (rDiff == 0)
            { //lost no weight
                System.out.println(sName + ", you lost no weight.");
            }
            else
                if (rDiff < 0)
                { //lost weight
                    System.out.println(sName + ", you lost " + Math.abs(rDiff) + "
kg.");
                    iTotNumLost++;
                }
                else
                {  //gained weight
                    System.out.println(sName + ", you gained " + rDiff + " kg.");
                    iTotNumGain++;
                }
            System.out.print("Enter name (zzz to stop): ");
            sName = keyboard.nextLine();
```

```
        } //while
        iSame = iCountMembers - iTotNumLost - iTotNumGain;
        System.out.println(iTotNumLost + " lost weight.");
        System.out.println(iTotNumGain + " gained weight.");
        System.out.println(iSame + " stayed the same.");
    }
}
```

Activity 8:   Calculate cumulative values

Act 8 a)

```java
package calcaverage;
import java.util.Scanner;
public class CalcAverage {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);

        int iNumLearners, iCounter = 0, iAvg;
        double rTotal = 0, rPerc;
        System.out.print("How many learners? ");
        iNumLearners = keyboard.nextInt();

        while (iCounter < iNumLearners)
        {
            iCounter ++;
            System.out.print("Enter percentage for learner " + iCounter + ": ");
            rPerc = keyboard.nextDouble();
            rTotal += rPerc;
        }

        iAvg = (int) Math.round(rTotal / iNumLearners);
        System.out.println("Average is " + iAvg + "%");
    }
}
```

Act 8 b)

Step	Instruction	rTotal	iNumLearners	iCounter	rPerc	iAvg	Outcome of logical expression	Output
1.	initialize	0						
2.	initialize			0				
3.	output/display							How many learners?
4.	input / enter		3					
5.	while evaluation						true	
6.	calculation			1				
7.	output / display							Enter percentage for learner 1
8.	input / enter				45.8			
9.	calculation	45.8						
10.	while evaluation						true	
11.	calculation			2				
12.	output / display							Enter percentage for learner 2
13.	input / enter				66.5			
14.	calculation	112.3						
15.	while evaluation						true	
16.	calculation			3				
17.	output / display							Enter percentage for learner 3
18.	input / enter				87.4			

19.	calculation	**199.7**						
20.	while evaluation						**False**	
21.	calculation					**67**		
22.	output / display							Average is 67%

Activity 9: Find the lowest value

```java
package findlowest;
import java.util.Scanner;
public class FindLowest {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);

        double rLowest = 100;
        double rPerc;

        System.out.print("Enter the student mark. (Enter a number that is larger than 100 to indicate all marks have been entered): ");
        rPerc = keyboard.nextDouble();

        while (rPerc <= 100)
        { //begin while
            if (rPerc < rLowest)
            {
                rLowest = rPerc;
            }
            System.out.print("Enter the student mark. (Enter a number that is more than 100 to indicate all marks have been entered): ");
            rPerc = keyboard.nextDouble();
        } //end while

        System.out.println("The Lowest percentage is: " + rLowest);
    }
}
```

```
package lowestandname;
import java.util.Scanner;
public class LowestAndName {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);

        double rLowest = 100;
        double rPerc;
        String sStudent = "";

        System.out.print("Enter the student mark. (Enter a number that is greater than 100 to indicate all marks have
been entered): ");
        rPerc = keyboard.nextDouble();

        while (rPerc <= 100)
        { //begin while
            keyboard.nextLine();  //clear the buffer since an integer was entered previously
            System.out.print("Enter the name of the student who scored " + rPerc + ": ");

            String sName = keyboard.nextLine();
            System.out.println();

            if (rPerc < rLowest)
            {
                rLowest = rPerc;
                sStudent = sName.toUpperCase();
            }
            System.out.print("Enter the student mark. (Enter a number that is more than 100 to indicate all marks have
```

```
been entered): ");
            rPerc = keyboard.nextDouble();
        } //end while


        System.out.println(sStudent + " obtained the lowest percentage!");
        System.out.println("The Lowest percentage is: " + rLowest);
    }
}
```

Activity 11: Improve Pizza toppings program

```
package menupizzatopimproved;
import java.util.Scanner;
import java.text.DecimalFormat;
public class MenuPizzaTopImproved {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        DecimalFormat formatter = new DecimalFormat ("R,##0.00");
        double rTotal = 0;        //The total amount the customer should pay
        int iOption;              //The menu option the user chooses
        int iCountMush = 0;
        int iCountHam = 0;
        int iCountCheese = 0;
        final double MUSHROOM = 8.50;
        final double HAM = 16.00;
        final double CHEESE = 6.50;

        System.out.println("\nChoose an option. \n1. Mushroom\t" + formatter.format(MUSHROOM) +
```

```java
                            "\n2. Ham\t\t" + formatter.format(HAM) + "\n3. Cheese\t" + formatter.format(CHEESE) +
                            "\n0. STOP ");
        iOption = keyboard.nextInt();
        while (iOption != 0)
        {
            switch (iOption)
            {
                case 1: rTotal = rTotal + MUSHROOM; iCountMush++; break;
                case 2: rTotal = rTotal + HAM; iCountHam++; break;
                case 3: rTotal = rTotal + CHEESE; iCountCheese++;
            } //end switch
            System.out.println("Your total so far is: " + formatter.format(rTotal));
            System.out.println("\nChoose an option. \n1. Mushroom\t " + formatter.format(MUSHROOM) +
                            "\n2. Ham\t\t " + formatter.format(HAM) +  "\n3. Cheese\t " + formatter.format(CHEESE) +
                            "\n0. STOP ");
            iOption = keyboard.nextInt();
        } //end while

        System.out.println("You ordered " + iCountMush + " mushroom topping(s)");
        System.out.println("You ordered " + iCountHam + " ham topping(s)");
        System.out.println("You ordered " + iCountCheese + " cheese topping(s)");
        System.out.println("You should pay " + formatter.format(rTotal));
    }
}
```

Act 12 a)

```java
package hoteldiscount;
import java.util.Scanner;
import java.text.DecimalFormat;
public class HotelDiscount {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        DecimalFormat formatter = new DecimalFormat ("R,##0.00");
        double rDiscount = 0;    //The total discount received
        int iNumber, iCount = 0;
        final double ZIP = 0.10; //discount received per activity
        final double HORSERIDING = 0.125;
        final double SITESEEING = 0.00;
        final double SPEEDBOAT = 0.10;

        System.out.print("\nHow much is your original hotel bill: R");
        double rBill = keyboard.nextDouble();
        System.out.print("\nHow many activities did you do?: ");
        iNumber = keyboard.nextInt();

        while (iCount < iNumber)
        {
            iCount++;
            System.out.println("\nActivities\tDiscount \n1. Zip-lining\t10%\n2. Horse riding\t12.5% \n3. Site seeing\t0%
\n4. SpeedBoat\t10% ");
            System.out.print("Pick your activity No " + iCount + " < options 1 to 4>: ");
            int iOption = keyboard.nextInt();
            switch (iOption)
```

```java
        {
            case 1: rDiscount = rDiscount + ZIP * rBill; break;

            case 2: rDiscount = rDiscount + HORSERIDING * rBill; break;

            case 3: rDiscount = rDiscount + SITESEEING * rBill; break;

            case 4: rDiscount = rDiscount + SPEEDBOAT * rBill; break;
        } //end switch


        System.out.println("So far, your discount is: " + formatter.format(rDiscount));


    } //end while


    System.out.println("\nYour total discount is: " + formatter.format(rDiscount));
    rBill = rBill - rDiscount;
    System.out.println("After discount, your bill will be " + formatter.format(rBill));
    }
}
```

```
package hoteldiscountmodified;
import java.util.Scanner;
import java.text.DecimalFormat;
public class HotelDiscountModified {
    public static void main(String[] args) {
        Scanner keyboard = new Scanner(System.in);
        DecimalFormat formatter = new DecimalFormat ("R,##0.00");
        double rDiscount = 0;    //The total discount received
        int iNumber, iCount = 0, iOption;
        final double zip = 0.10; //discount received per activity
        final double horseRiding = 0.125;
        final double siteSeeing = 0.00;
        final double speedBoat = 0.10;

        System.out.print("\nHow much is your original hotel bill: R");
        double rBill=keyboard.nextDouble();
        System.out.print("\nHow many activities did you do?: ");
        iNumber = keyboard.nextInt();

        while (iNumber < 0 || iNumber > 4)
        { //begin while
            System.out.print("You should only enter an integer from 0 to 4 \nPlease re-enter the number of activities you
did: ");
            iNumber = keyboard.nextInt();
        } //end while

        System.out.println("\nActivities\tDiscount \n\n1. Zip-lining\t10%\n2. Horse riding\t12.5% \n3. Site seeing\t0%
\n4. SpeedBoat\t10% ");
```

```java
        while (iCount < iNumber)
        {
            iCount++;
            System.out.print("Pick your activity No " + iCount + " < options 1 to 4>: ");
            iOption = keyboard.nextInt();
            while (iOption < 0 || iOption > 4)
            { //begin while
                System.out.print("You should only enter an integer from 0 to 4 \nPlease re-enter your activity number: ");

                iOption = keyboard.nextInt();
            } //end while

            switch (iOption)
            {
                case 1: rDiscount = rDiscount + zip * rBill; break;
                case 2: rDiscount = rDiscount + horseRiding * rBill; break;
                case 3: rDiscount = rDiscount + siteSeeing * rBill; break;
                case 4: rDiscount = rDiscount + speedBoat * rBill; break;
            } //end switch

            System.out.println("So far, your discount is: " + formatter.format(rDiscount));

        } //end while

        System.out.println("\nYour total discount is: " + formatter.format(rDiscount));
        rBill = rBill - rDiscount;
        System.out.println("After discount, your bill will be " + formatter.format(rBill));
    }
}
```