NUI Galway
OÉ Gaillimh

Semester II Examinations, 2018/2019

Exam Code(s)	2BCT
Exam(s)	2nd Year B.Sc. (CS&IT)
Module Code(s)	CT255
Module(s)	NEXT GENERATION TECHNOLOGIES II
Paper No.	1
Repeat Paper	Special Paper
External Examiner(s)	Dr. Jacob Howe
Internal Examiner(s)	Professor Michael Madden
	*Dr. Sam Redfern
	*Dr. Michael Schukat

Instructions:

Time allowed: **2** hours
Answer 2 questions from section A and 2 questions from section B

All questions carry equal marks
USE **SEPARATE** ANSWER BOOKS FOR EACH SECTION

Duration	2 hrs
No. of Answer books	2

Requirements:

Handout	
MCQ	
Statistical Tables	
Graph Paper	
Log Graph Paper	
Graphic Material in colour	YES
No. of Pages	8
Discipline(s)	Information Technology
Course Co-ordinator	Dr. Des Chambers

SECTION A
Information Systems in Healthcare
Answer <u>any 2</u> questions from this section

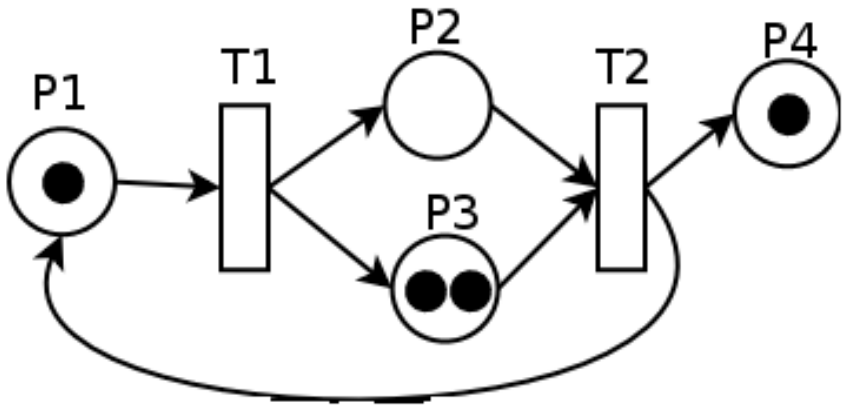
Q.1.

(i) Briefly outline the structural elements and inner workings (e.g. state changes) of a **Petri net**.

[4]

Using the example below determine the **boundedness** of P1, P2, P3 and P4 and comment on the **liveness** of the Petri net. Provide definitions for both terms.

[2]



(ii) What are the 4 **atomic routing constructs** typically used in workflow modelling? Use examples with a medical context to illustrate your answer.

[4]

(iii) Briefly discuss how network communication can be compromised via **active attacks** and **passive attacks**. Further on, outline how such attacks are linked to **data protection** and **data security**.

[8]

(iv) Using an example with a medical context explain the term **declarative knowledge**.

[2]

<u>PTO</u>

Q.2.

(i) Describe in detail, how in the German Health Care system GPs and SPs (settled physicians) are reimbursed for their services by health insurance companies.

[6]

Discuss how this system could be adopted to reimburse Irish GPs for their treatment of medical card holders.

[2]

(ii) What is meant by a drug with a **low therapeutic index**? Use a diagram to support your answer.

[4]

(iii) The table below shows the test results of the fecal occult blood (FOB) screen test and a subsequent endoscopy of 200 patients. Comment on the distribution of results, making explicit reference to the **sensitivity** and **specificity** of the FOB test, therefore arguing whether or not it is a good **screening test**.

[5]

Further on, outline under what circumstances the FOB test would be a **pathognomonic** test.

[1]

		Patients with confirmed bowel cancer (via endoscopy)	
		True (3)	False (197)
FOB TEST	Positive (20)	TP = 2	FP = 18
	Negative (180)	FN = 1	TN = 179

(iv) What is meant by the **Body-Mass Index (BMI)**?

[2]

PTO

Q.3.

(i) What is **diabetes**? In your answer refer to the terms **type I diabetes, type II diabetes**, **insulin**, the **carbohydrate metabolism**, **ketoacidosis**, **basal insulin** and **bolus insulin**.

[8]

(ii) Using an example discuss the characteristics of the **SOAP structure** in the **problem-oriented medical record**.

[4]

(iii) Summarise characteristics of and differences between the following types of **artificial pancreas systems**:

- The Threshold Suspend Device
- The Control-to-Range Device
- The Control-to-Target Device

[5]

(iv) Distinguish between the terms **primary healthcare**, **secondary healthcare** and **tertiary healthcare**. In your answer, refer also to the **Healthcare Pyramid**.

[3]

PTO

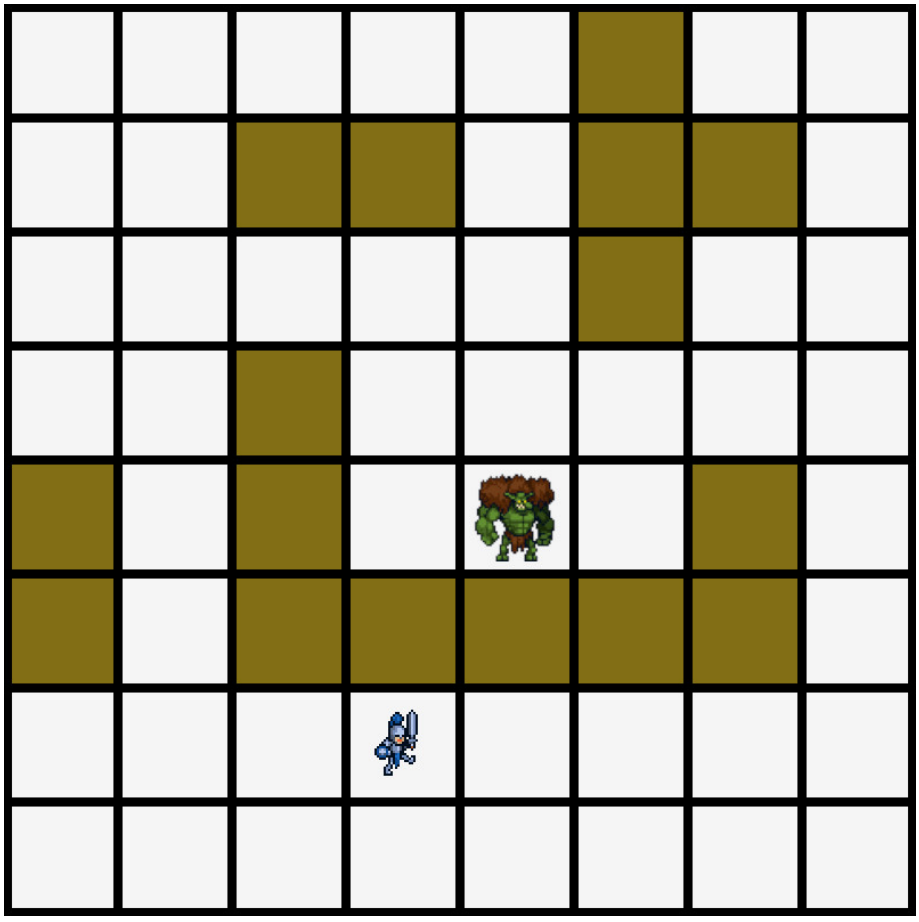
SECTION B
2D GAMES PROGRAMMING WITH JAVA
Answer <u>both</u> questions from this section

Q.4. A* Pathfinding

(i) Write a pseudocode outline of the A* pathfinding algorithm. Your answer should include the initialization stage as well as the general (looping) step, and an indication of where the success or failure of the algorithm is identified. Your answer should include the terms: node, open list, closed list, parent node, expanding a node. You do not need to include the construction of the final path that was discovered. [10]

(ii) Explain each of the three components of the A* cost calculation: F = G + H. Explain also how each of these components is calculated, noting any assumptions made. [5]

(iii) In the 2D game depicted below, a 'troll' character, under control of the computer, needs to navigate to a 'knight' character. Movements may only be made horizontally or vertically, by a full square at a time. The shaded squares represent impassable walls. Annotate and submit the following diagram (**detachable version on final page of this exam paper**) with F, G, H values and parent node indication arrows for each square that will have been considered (i.e. added to the open list) before the correct path is discovered. [5]



Q.5. Consider the simple Java game illustrated here. A player-controlled character, moved by the arrow keys, must attempt to escape from 30 'bad guys' who move towards them.

The code provided below (2 pages) provides most of the requirements of the **MainApplication** class for this game. In addition, the game uses a **BadGuy** class and a **Player** class, which are used for the game objects.

(i) Write the **BadGuy** class and **Player** class. These classes require member data to store their positions, movement directions, and Images. They also require constructors, move( ) methods and paint( ) methods. See (iii) below for a description of game object movements. [8]

(ii) Implement the keyboard handler methods as indicated by the "TO DO" comments in the code below. The arrow keys should modify the movement direction of the Player object [6]

(iii) In the **MainApplication** class' run( ) method, write appropriate code to move the game objects. The **Player** object moves in the direction indicated by the keyboard arrow keys, while the **BadGuy** objects move directly towards the **Player** object's current position. [6]

```
import java.awt.*;
import java.awt.event.*;
import javax.swing.*;

public class MainApplication extends JFrame implements Runnable,
KeyListener {
   // application data
   private static final int NUMBADGUYS = 30;
   private BadGuy[] BadGuysArray = new BadGuy[NUMBADGUYS];
   private Player player;

   // constructor
   public MainApplication() {
      // setup application window
       setBounds(50, 50, 500, 500);
       setVisible(true);
      setTitle("Bad Guys!");

      // load raster graphics and instantiate game objects
      ImageIcon icon = new ImageIcon("C:\\badguy.png");
      Image img = icon.getImage();
      for ( int i=0; i<NUMBADGUYS; i++ ) {
         BadGuysArray[i] = new BadGuy(img);
      }
      icon = new ImageIcon("C:\\player.png");
      img = icon.getImage();
      player = new Player(img);

      // create and start animation thread
      Thread t = new Thread(this);
```

```
      t.start();

      // receive keyboard events
      addKeyListener(this);
   }

   // thread's entry point
   public void run() {
      while ( 1==1 ) {
         // 1: sleep for 1/50 sec
         try {
            Thread.sleep(20);
         } catch (InterruptedException e) { }

         // 2: move game objects
         // TO DO ------------------------------

         // 3: force an application repaint
         this.repaint();
      }
   }

   // Three Keyboard Event-Handler functions
     public void keyPressed(KeyEvent e) {
      // control the player character with the arrow keys
      // TO DO ------------------------------
     }

     public void keyReleased(KeyEvent e) {
      // control the player character with the arrow keys
      // TO DO ------------------------------
     }

     public void keyTyped(KeyEvent e) { }

   // application's paint method
   public void paint(Graphics g) {
      // clear the canvas with a black rectangle
      g.setColor(Color.BLACK);
      g.fillRect(0, 0, 500, 500);

      // paint the game objects
      player.paint(g);
      for ( int i=0; i<NUMBADGUYS; i++ ) {
         BadGuysArray[i].paint(g);
      }
   }

   // application's entry point
   public static void main(String[] args) {
      MainApplication m = new MainApplication();
   }
}
```

You may complete this page and submit your exam paper as part of your answer to Q.4.

Student ID _____