OFFICE OF TASMANIAN ASSESSMENT, STANDARDS & CERTIFICATION

External Assessment 2022

Attach your candidate label here

COMPUTER SCIENCE

ITC315118

Section A

Pages	12
Questions	3
Information Booklet	1

Preparation time for this exam: 15 minutes

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
- Take care with presentation of answers and use **complete sentences** for questions needing explanations.
- The exam is **three (3)** hours in length. It is suggested that you spend **approximately 36 minutes** in total answering the questions in this section.
- **Show all working out** used in deriving answers and use diagrams where appropriate.
  - **Extra space for answering** is at the end of the section. If used, you **must** indicate you have done so next to the relevant question.
- The **Computer Science Information Booklet** can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address:
  - Criterion 1 design, extend and improve algorithmic solutions to a range of problems.

Marker Use	
C1	/ Alpha

Blank Page

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Final mark
Section A	3	3	36 minutes	Assessed using extended ratings of: A+ to z
Section B	3	3	36 minutes	
Section C	3	3	36 minutes	
Section D	3	3	36 minutes	
Section E	3	3	36 minutes	
Totals	**15**	**15**	**180 minutes (3 hours)**	

Question 1

Marker use

The following partially completed algorithm is used to calculate the cost of a new Personal Computer (PC). The base price includes the PC case, power supply, keyboard and mouse.

The customer can then select from the following options:

- **memory** can be 8 (minimum), 16 or 32 MB
- **processor** can be ‘n’ (normal) or ‘p’ (power processor)
- **video** can be 'o' (onboard graphics) or 'd' (dedicated video card)

The character 'x' and number -1 are used to show that an option has not been selected.

Line numbers are for reference only.

```
1   Initially
2     set memory = -1
3     set processor = 'x'
4     set video = ‘x’
5     set basePrice = 300
6     set total = 0
7
8   When the user selects an option from the memoryChoice ComboBox
9     set memory to the value in memoryChoice ComboBox
10    if memory = 8
11          set memoryPrice to 50
12    if memory = 16
13          set memoryPrice to 100
14    if memory = 32
15          set memoryPrice to 200
16
17  When the user selects an option from the processorChoice ComboBox
18    set processor to the value in processorChoice ComboBox
19    if processor= 'n'
20          set processorPrice to 200
21    else
22          set processorPrice to 500
23
24  When the user selects an option from the videoChoice ComboBox
25    set video to the value in videoChoice ComboBox
26    if video = 'o'
27          set videoPrice to 0
28    else
29          set videoPrice to 500
30
31  When the calculate Button is pressed
32    if memory = -1 or processorSelected = ‘x’ or videoOption = 'x'
33          display "Please set all options before proceeding"
34    else
35          total = basePrice + memoryPrice + processorPrice + videoPrice
36          display "Your computer costs " total
```

Question 1 continues

Marker use

a) What is the price of the cheapest available PC?
(circle **the** correct answer)

$300 $350 $500 $550

b) What is the cost of the most expensive PC available?
(circle **the** correct answer)

$500 $1000 $1500 $2000

c) The price of the dedicated video card has risen by 100% due to COVID-19 supply shortages. Indicate what line(s) would need to be modified and list the required modification(s) to apply this increase.

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d) It would not be advisable to buy the dedicated graphics card and not choose the power processor.

Describe how you would adjust the algorithm to alert the user that this would not be a wise option?

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Section A continues

Marker use

Question 2

The following is a ***partially completed*** algorithm for the control panel of a mechanical tennis ball launching machine. The machine can launch balls with the following settings:

Speed : 40 – 110 kph

Spin : flat, topspin, underspin, random (F, T, U, R)

Sweep : narrow, medium, wide (1, 2, 3)

The panel has three presets for **novice**, **intermediate**, and **advanced** players.

Initially

user = "intermediate"

spin = 'T'

speed = 60

sweep = 2

When "speed" button is pressed

speed = speed + 10

When "sweep" button is pressed

sweep = sweep modulo 3 + 1 (note: sweep modulo 3 gives the remainder after dividing sweep by 3)

When "spin" button is pressed

case spin of :

'F': set spin to 'T'

'T': set spin to 'U'

'U': set spin to 'F'

end case

When "novice preset" button is pressed

set user to "novice"

set speed to 40

When "intermediate preset" button is pressed

set user to "intermediate"

set speed to 60

When "advanced preset" button is pressed

Set user to "advanced"

Set speed to 80

Question 2 continues

Marker use

a) The “speed” button is incomplete. The speed should not exceed 110 and resets to 40 on the next button press at the maximum. Show how this can be achieved.

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b) If the user is **novice** the speed should be incremented by 5, with a maximum value of 65, resetting to 40 after the maximum. Make changes to reflect these requirements.

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c) There is no option to select a random (R) spin option. Modify the code to provide for this.

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Section A continues

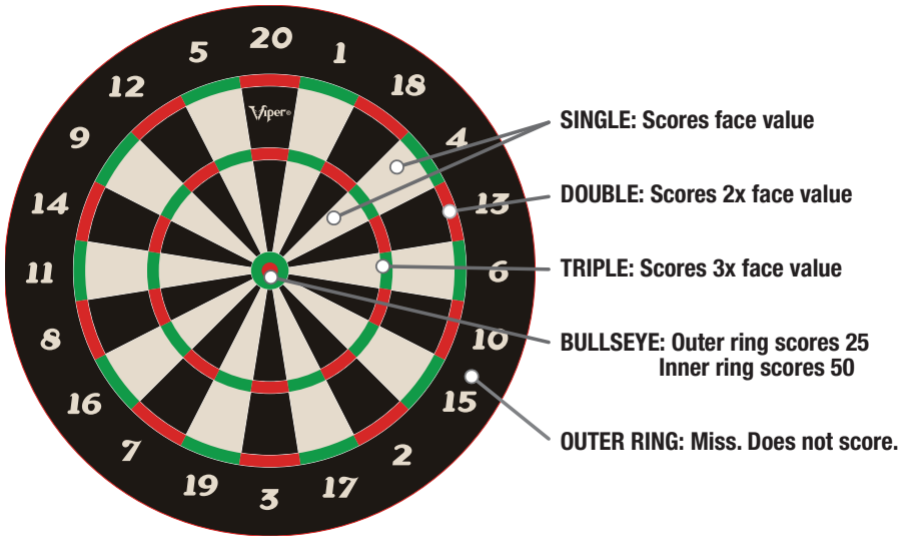
Marker use

Question 3

In a popular darts game, two players each starts with a score of 501 and takes turns to throw 3 darts. Develop an algorithm to record the players' score and to determine the winner, using the below scoring rules:

- the score for each turn is calculated and deducted from the players total.
- bullseye scores 50, the outer ring scores 25.
- a dart in the double or triple ring counts 2x or 3x the section score.
- the objective is to be the first player to reduce the score to exactly zero (0).
- the last dart thrown must land in a double ring section or the bullseye.
- if a player reduces the score to 1 or goes below zero, the score is bust*, that turn ends immediately and the score is returned to what it was at the start of that turn.
    - for example, if a player has 32 to win nd the first dart is a 16, the second is a 15, the player is bust* and the players score is returned to 32.
- on the last turn, it is not necessary to throw all 3 darts - a player can win with the first or second dart of the turn.

*if points go below zero (0), it is called a bust.



Develop an algorithm to record players' scores and to determine the winner.

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Question 3 continues

Marker use

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Extra Answer Space:

Write the question number you are answering in the box.

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End of Section A

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COMPUTER SCIENCE

ITC315118

Section B

Pages	16
Questions	3
Information Booklet	1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
- Take care with presentation of answers and use **complete sentences** for questions needing explanations.
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  - **Extra space for answering** is at the end of the section. If used, you **must** indicate you have done so next to the relevant question.
- The **Computer Science Information Booklet** can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address:
  - Criterion 2 create programs in a high-level programming language.

Marker Use	
C2	/ Alpha

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Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Final mark
Section A	3	3	36 minutes	Assessed using extended ratings of: A+ to z
Section B	3	3	36 minutes	
Section C	3	3	36 minutes	
Section D	3	3	36 minutes	
Section E	3	3	36 minutes	
Totals	**15**	**15**	**180 minutes (3 hours)**	

Question 4

Marker use

a) Circle **the** correct answer for the following questions:

i. What will be the value of **y** and **z** after the following code is executed?

```
int x,y,z;
x = 8;
y = x + 9 / 3;
z = Math.max(x, y);
```

*(circle the **one (1)** correct answer for each)*

y	5.666	8.0	8	11
z	5.666	8.0	8	11

ii. What will be the value of **x** after the following code is executed?

```
double x;
x = 5.0 + Math.pow(2.0, 3.0)
```

*(circle **the** correct answer)*

13	13.0	14	14.0

iii. What will be the value of **c** after the following code is executed?

```
int c = 3;
if (c <= 3){
    c = c - 1;
} else {
    if (c > 1)
    {
        c = 5;
    }
}
```

*(circle **the** correct answer)*

1	2	4	5

b)

i. What will be the final value of **d** after the following code is executed?

```
boolean d;
d = !true;
```

Find the value of **d**: .....

Question 4 continues

Marker use

ii. What will be the final value of **e** after the following code is executed?

```
int e = 5;
if (e > 0) {
    e = e * 2;
}
if (e > 10) {
    e = e - 2;
}
```

Find the value of **e**:.....

Explanation: .....

.....

iii. Trace the following code and find the final value of the variable **f**.

```
int f = 0;
for (int i = 1; i <= 4; i++) {
    f = f + 2 * i;
}
```

i	f

Find the value of **f**: .....

iv. Trace the following code and find the final value of the variable **d**.

```
int d = 0;
int y = 0;
while (y <= 4){
    y = y + 3;
    d = 2 * y;
}
```

y	d

Find the value of **d**: .....

Question 4 continues

Marker use

c) The following description of a method has been provided. Complete the missing code using correct Java syntax.

This method accepts one parameter labelled **"cost"** representing the cost of an item purchased inclusive of the GST (10%). This method should return the amount of GST paid on this item. The GST is calculated by dividing the cost by 11.

```
public double question4c (double cost)
// the value "input" is the value passed into the method.
{
        double output;









        return output;
}
```

Section B continues

Marker use

Question 5

a)

```
int[] data = {2,5,1};
int k = 0;
for (int i = 0; i <= 2; i++){
    if (i == 0){
        k = k + data[i];
    }
    else {
        k = k + data[i] + data[i-1];
    }
}
```

Trace the above code and find the final value of the variable **k**.

i	k	data		
		0	1	2

Find the value of **k**: .....

b) The following method can be used to check if the sum of the values passed as parameters is even or odd. Write code to call the following method. Be sure to declare and initialise any variables that may be required to complete this task.

```
public String part5b(int  x, int y, int  z)
{
    if (x + y + z) % 2 == 0
        return “Even”;
    else
        return “Odd”;
}
```

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Question 5 continues

Marker use

c)

```
int[][] m = new int[3][4];
for (int i = 0; i < 3; i++){
    for (int j = 0; j < 4; j++){
        if (i == j)
            m[i][j] = i*3;
        else
            m[i][j] = j+1;
    }
}
```

Use the array diagram below to trace the above code and find the final values in the array **m**.

m	0	1	2	3
0				
1				
2				

Explain what error would occur if the array was defined as:

```
int[][] m = new int[4][3];
```

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Section B continues

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Exam continues over the page

Marker use

Question 6

This question relates to the program on page 11. The numbers on the left are not part of the program and are provided for reference purposes.

a) Trace the program to determine the final values of **sumx** and **sumy**.

sumx = ...

sumy = ...

b) Below is an alternative definition of the method ***sumArray*** from the one in the program on lines 19 – 25. It is used to sum all the values in the array ***a***.

```
public void sumArray(double[] a, double suma){
    suma = 0;
    for(int i = 0; i < 7; i++)
        suma = suma + a[i];
}
```

To use **this** definition of the method ***sumArray*** lines 29 and 30 need to be changed to match as below:

```
sumArray(x,sumx);
sumArray(y,sumy);
```

Explain why this alternative definition of method ***sumArray*** would not produce the correct result.

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c) If the following changes were made to the number of values in the arrays, the program will not give the correct result.

```
x = new double[] {2, 5, 12, 17, 34, 18, 56, 123};
y = new double[] {13, 18, 34, 44, 105, 74, 125, 243};
```

i. Explain why the program will not produce the correct result when this change is made.

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ii. Indicate the modification you need to make to the program to ensure it will work correctly for these new values of **x** and **y**.

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Question 6 continued

```
1   class Stats {
2
3       double meanx;
4       double meany;
5       double sumx;
6       double sumy;
7       double diffxy;
8       double diffxs;
9       double diffys;
10      double r;
11      double[] y = {1, 7, 13, 17, 39, 12, 66};
12      double[] x = {12, 18, 39, 54, 95, 48, 105};
13      String result;
14
15      public void run(){
16          result = "Result is: " + calculateStats();
17      }
18
19      public double sumArray(double[] a){
20          double suma = 0;
21          for(int i = 0; i < 7; i++) {
22              suma = suma + a[i];
23          }
24          return suma;
25      }
26
27      public double calculateStats() {
28
29          sumx = sumArray(x);
30          sumy = sumArray(y);
31          meanx = sumx/x.length;
32          meany = sumy/x.length;
33          diffxy = 0;
34          diffxs = 0;
35          diffys = 0;
36          for (int i = 0; i < x.length; i++) {
37              diffxy = diffxy + (x[i]-meanx)*(y[i]-meany);
38              diffxs = diffxs + Math.pow(x[i]-meanx,2);
39              diffys = diffys + Math.pow(y[i]-meany,2);
40          }
41          return r = diffxy/(Math.sqrt(diffxs) * Math.sqrt(diffys));
42      }
43
44      public static void main(String[] a) {
45          Stats qSix = new Stats();
46          qSix.run();
47          System.out.println("Correlation coefficient is: " + qSix.result);
48
49      }
50  }
```

Extra Answer Space:

Write the question number you are answering in the box.

Marker use

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End of Section B

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COMPUTER SCIENCE

ITC315118

Section C

Pages	12
Questions	3
Information Booklet	1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
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- All answers must be written in **English**.
- You **must** make sure your answers address:
  - Criterion 3 use appropriate objects in the design of programs.

Marker Use	
C3	/ Alpha

Blank Page

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Final mark
Section A	3	3	36 minutes	Assessed using extended ratings of: A+ to z
Section B	3	3	36 minutes	
Section C	3	3	36 minutes	
Section D	3	3	36 minutes	
Section E	3	3	36 minutes	
Totals	**15**	**15**	**180 minutes (3 hours)**	

Question 7

Marker use

Consider the following class definition for the climate control system in a car.

```
public class ClimateControl
{
   double temperature; // Temperature in ºC.
   int fan;                  // The fan speed setting.
   boolean start;            // Will be true if the climate control system
                             // is to start up when the car starts otherwise false.

   public ClimateControl(double inTemp, int inFan, boolean inStart)
   {
      temperature = inTemp;
      fan = inFan;
      start = inStart;
   }
   public int getFan()
   {
       return fan;
   }
   public double getTemp()
   {
       return temperature;
   }
   public boolean getStart()
   {
       return start;
   }
   public void toggleStart()
   {
        start = !start ;
   }

   public void setFanUp()
   {
       if (fan < 5)
           fan = fan + 1;
   }
   public void setFanDown()
   {
       if (fan > 0)
           fan = fan - 1;
   }
   public void setTempUp()
   {
       if (temperature < 40)
           temperature = temperature + 0.5;
   }
   public void setTempDown()
   {
       if (temperature > 0)
           temperature = temperature - 0.5;
   }
} // end of ClimateControl class
```

Question 7 continues

Marker use

a) Which of the following statements will create a ClimateControl?
(circle **the** correct answer)

ClimateControl c = new ClimateControl (27, 6);

ClimateControl c = new ClimateControl (27.0, 3);

ClimateControl c = new ClimateControl (27.0, 6, “true”);

ClimateControl c = new ClimateControl (27.0, 3, false);

b) What is the minimum fan setting?
(circle **the** correct answer)

-1 0 1 2

c) What data type does the getTemp method return?
(circle **the** correct answer)

void double int boolean

d) On a hot day, it takes too long to adjust the temperature by 0.5 ºC at a time. Add a new method into the object that allows for an adjustment of 10 ºC down at a time. Ensure that the minimum temperatures are maintained.

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Section C continues

Marker use

Question 8

The class definition below defines a collection of coins.

```
public class Coins{

    private double[] faceVal = new double[100];
    private double[] collectVal = new double[100];
    private String[] country = new String[100];
    private String[] year = new String[100];
    private int number;

    public Coins(){
        number = 0;
    }

    public void enter(double faceEnter, double collectEnter,
        String countryEnter, String yearEnter){

        faceVal[number] = faceEnter;
        collectVal[number] = collectEnter;
        country[number] = countryEnter;
        year[number] = yearEnter;
        number = number + 1;
    }

    public double getFace(int index){
        return faceVal[index];
    }

    public double getCollect(int index){
        return collectVal[index];
    }

    public String getCountry(int index){
        return country[index];
    }
     public String getYear(int index){
        return year[index];
     }

     public int getNumber(){
        return number;
     }
}
```

Question 8 continues

Marker use

a) Using the class definition, write code to declare and instantiate a variable of the object type defined by the class.

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b) Using the method **enter()** and the variable from part **(a)**, add a coin to the collection with the following properties: country = **Australia**, collector value = **700**, year = **1958**, face value = **500**.

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c) Occasionally, a coin needs to be revalued. Construct a method which will allow the collectVal of a coin to be updated.

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d) Using the **getNumber()** and **getCollect()** methods, write code to sum the collector values of all the coins in the collection.

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Section C continues

Marker use

Question 9

A class is needed to record information on electric vehicle charging stations across Tasmania.

The information to be processed is as follows:

Data Item	Type of Data
Location	Name of town where charging station is located
Address	Address of charging station
Capacity	Maximum capacity in kilowatts (kW)
Quantity	Number of charging bays
PlugTypes	Type1, Type2 or both
Nearest Type 1 Station	Distance in kilometres (km) to the nearest charging station from this one with type 1 plug
Nearest Type 2 Station	Distance in km to the nearest charging station from this one with type 2 plug

Create a class to hold the specified data and that contains the methods specified.

The class will contain the following methods:

- A constructor method that will set the initial value for each charging station using parameters with the data item listed in the table above.
- Methods that will return the **Location**, **Capacity** and **PlugTypes** of the charging station.
- A method that will enable the user to enter the range of their vehicle and type of plug used that will return a **true** or **false** value to indicate if their vehicle is capable of making it to the nearest charging station from this one. (Note: *the user will need to pass as parameters the range of their vehicle in km and its PlugType*)

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Question 9 continues

Marker use

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Extra Answer Space:

Write the question number you are answering in the box.

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End of Section C

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Section D

Pages	16
Questions	3
Information Booklet	1

Suggested working time: 36 minutes

Instructions:

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- You **must** make sure your answers address:
  - Criterion 4 describe and apply knowledge of computer architecture.

Marker Use	
C4	/ Alpha

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Guide to Exam Structure

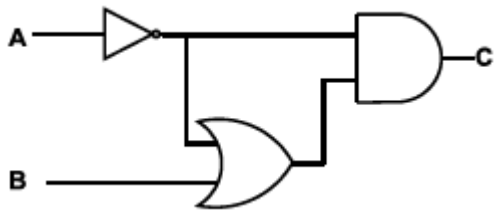
	Questions available	Questions to answer	Suggested working time	Final mark
Section A	3	3	36 minutes	Assessed using extended ratings of: A+ to z
Section B	3	3	36 minutes	
Section C	3	3	36 minutes	
Section D	3	3	36 minutes	
Section E	3	3	36 minutes	
Totals	**15**	**15**	**180 minutes (3 hours)**	

Question 10

Marker use

a) Circle **the** correct answer in the following questions.

i. Select the logic expression which represents the following circuit:



~A ∧ (B ∨ A)

~A ∨ B ∧ A

~ A ∧ ~ A ∨ B

~A ∧ (~ A ∨ B)

ii. Fill in the "truth" table and circle **the** correct answer below.

A	**B**	**~ A ∧ B**
F	F	
F	T	
T	F	
T	T	

~ A ∧ B
F
T
F
T

~ A ∧ B
F
T
F
F

~ A ∧ B
T
F
F
F

~ A ∧ B
T
T
F
T

iii. Circle the simplified expression for **A ∨ F.**

T **A ∨ F** **A** **F**

Question 10 continues

Marker use

b)

i. Complete the truth table for the following expression:

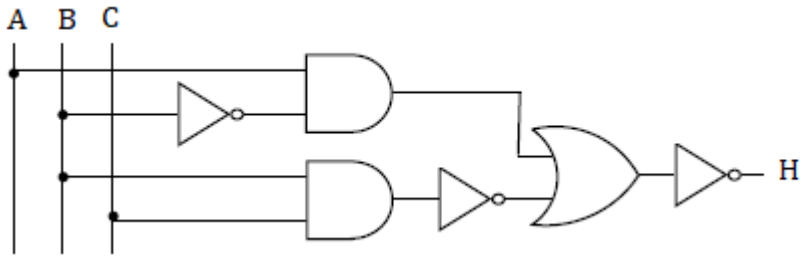
F ≡ (~B ∧ C) ∨ (A ∨ B)

A	B	C	~B	~B ∧ C	A ∨ B	F
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

ii. Draw the logic circuit for the expression for **G**:

G ≡ ~ (~A ∨ (B ∧ ~ A)) ∧ (C ∨ B)

iii. Give the logic expression for **H**:



H ≡.....

Question 10 continues

Marker use

c) Consider the following TOY program. What is the value of register C upon program termination? Fill in the Pseudocode and Explanation boxes to show what each line of code does.

Memory Address	Contents	Pseudocode	Explanation
01	0007	data	mem[01] contains value 7
02	0004		
10	8A01		
11	8B02		
12	2CAB		
13	0000		

On program termination R[C] = ...

Section D continues

Marker use

Question 11

a)

i. Produce a simple logic expression for H from the following Karnaugh map.

		C				
		0	**0**	**1**	**1**	
A	**0**	1	0	0	1	**0**
	0	0	1	1	0	**1**
	1	0	1	1	0	**1**
	1	1	0	1	1	**0**
		0	**1**	**1**	**0**	**B**

D

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ii. Use logic laws to simplify the following logic expression:

~A v (A ∧ B)

Indicate which logic law(s) were applied to each stage of your answer.

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Question 11 continues

Marker use

b) In the TOY there is a branch zero (opcode C) and a branch positive (opcode D) but no branch negative. Explain why this is the case and demonstrate how this is overcome by combining existing commands.

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c) The Java Virtual Machine (JVM) allows Java code to be run on a wide variety of computers with completely different hardware and instruction sets. Explain how the JVM makes this possible.

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Section D continues

Marker use

Question 12

a) Complete the following TOY program so that it will implement the Java code below.

```
x = 3;
if ( x > 3 )
        y = x;
else
        y = x * 2;
```

Memory Address / PC	Contents	Pseudocode	Explanation
01	0003	data	Constant 3
02	0000	data	Used for variable y
03	0003	data	Used for variable x
04	0001	data	Constant decimal 1
10	8A01	R[A] <- mem[01]	

Question 12 continues

Marker use

b) Using the trace table on page 11, trace the following TOY program using the following values inputted by the user:

11 12

Memory Address / PC	Contents	Pseudocode	Explanation
01	0000	data	used for variable x
10	8AFF		R[A] = input from keyboard
11	8BFF		R[B] = input from keyboard
12	3DAB	R[D] <- R[A] & R[B]	
13	4EAB	R[E] <- R[A] ^ R[B]	
14	1CDE	R[C] <- R[D] + R[E]	
15	9C01		

What value will be stored in memory location 01 after the execution of this code?

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What is the purpose of this program?

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Question 12 continues

Marker use

Trace table for Question 12 b)

PC	Contents	R[A]	R[B]	R[C]	R[D]	R[E]	mem[01]

Extra Answer Space:

Write the question number you are answering in the box.

Marker use

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End of Section D

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COMPUTER SCIENCE

ITC315118

Section E

Pages	12
Questions	3
Information Booklet	1

Suggested working time: 36 minutes

Instructions:

- Answer **all** questions and **all** items within each question.
- Write your answers in the spaces provided in this exam paper.
- Take care with presentation of answers and use **complete sentences** for questions needing explanations.
- The exam is **three (3)** hours in length. It is suggested that you spend **approximately 36 minutes** in total answering the questions in this section.
- **Show all working out** used in deriving answers and use diagrams where appropriate.
  - **Extra space for answering** is at the end of the section. If used, you **must** indicate you have done so next to the relevant question.
- The **Computer Science Information Booklet** can be used throughout this exam.
- All answers must be written in **English**.
- You **must** make sure your answers address:
  - Criterion 5 analyse how data are represented and stored.

Marker Use	
C5	/ Alpha

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Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Final mark
Section A	3	3	36 minutes	Assessed using extended ratings of: A+ to z
Section B	3	3	36 minutes	
Section C	3	3	36 minutes	
Section D	3	3	36 minutes	
Section E	3	3	36 minutes	
Totals	**15**	**15**	**180 minutes (3 hours)**	

Question 13

Marker use

a)

i. When $3C_{16}$ is converted to binary the value is:

*(circle **the** correct answer)*

01101011_2 00111010_2 00111100_2 01111010_2

ii. When 100111_2 is converted to decimal the value is:

*(circle **the** correct answer)*

16 32 39 45

iii. What is the ASCII code (in decimal) for the character 'F'?

*(circle **the** correct answer)*

6 65 70 102

b) Fill in the **four (4)** missing bits in the following binary addition.

	1	☐	1	☐	0
+	0	1	0	1	1
1	☐	0	☐	0	1

c)

i. Using 8 bit two's complement representation, 96 is represented as

01100000_2

How would 103 be represented?

103 .....

ii. What is the representation of -96 using 8 bit two's complement representation?

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iii. Perform the following two's complement arithmetic: 103 – 96 (Show working out).

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Question 13 continues

Marker use

d) Convert $3CAB_{16}$ to binary.

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e) Explain why 0.101_2 is equal to $0.625_{10.}$

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Section E continues

Marker use

Question 14

a) Explain what is meant by the term overflow. Using a four bit two's complement system, demonstrate the binary addition of **two (2)** numbers that would cause an overflow.

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b) Convert 0.1011_2 to decimal (show all working out).

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c) In earlier years, car registrations used to be: letter letter digit digit digit digit **eg AB1234.**

What is the minimum number of bits required to store all possible registration numbers using this scheme? (Show working out.)

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d) A sixteen-bit word is used to store floating point numbers as shown in the diagram below. Bits M7 to M0 store the normalised mantissa ($0 \leq \text{mantissa} < 1$). Bits E5 to E0 store the unsigned exponent. The sign bits use '1' to represent '-' and '0' for '+'. What **decimal** number is represented below?

Exponent Sign	Mantissa Sign	E5	E4	E3	E2	E1	E0	M7	M6	M5	M4	M4	M2	M1	M0
0	1	0	0	1	0	1	1	1	1	1	0	0	0	0	0

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Question 14 continues

Marker use

e) Explain why 0.3_{10} (which is finite in decimal) is a recurring number in binary which cannot be represented exactly. Convert 0.3_{10} to binary to explain your answer.

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Section E continues

Marker use

Question 15

a) A database of holiday rental houses located in Tasmania is to be constructed for a local firm, TasRentals. The database will be used as the backend to a website where people will be able to book accommodation. Each individual record needs to contain the following information:

- The address of the property (up to 100 characters max)
- The cost per night (up to $1000 max (whole dollars only))
- The number of people that can be accommodated (up to 10 max)
- Whether the property has off street parking or not

i. The database needs to be able to store up to 1000 properties. Calculate the minimum number of bits required to store this information. (Show all working out.)

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ii. If TasRentals required the cost per night to include cents, what would the minimum number of bits required to store this information now be? (Show all working out.)

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iii. TasRentals also need to store images of each property. They had the images professionally photographed and they are in a RAW file format ranging from 20 to 40MB per image. What advice, around file types and compression, would you give them about including these images in the database? Explain your answer.

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Marker use

Question 15 continued

b) A one-dimensional integer array has been stored in the memory of a computer system. An array variable **data** references the address of the memory location that contains the length of the array. The memory locations after this address contain the contents of the array. The value of the array variable **data** and a section of memory are shown below.

Value of array variable ***data***: 01AE02

Memory Address	Content
01AE00	4
01AE01	3
01AE02	7
01AE03	5
01AE04	6
01AE05	0
01AE06	8
01AE07	1
01AE08	2
01AE09	9
01AE0A	10
01AE0B	11

i. Give a possible Java declaration for the one-dimensional array variable **data** represented by the above information.

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ii. What value is stored in the final element of the array variable **data**? Explain your answer.

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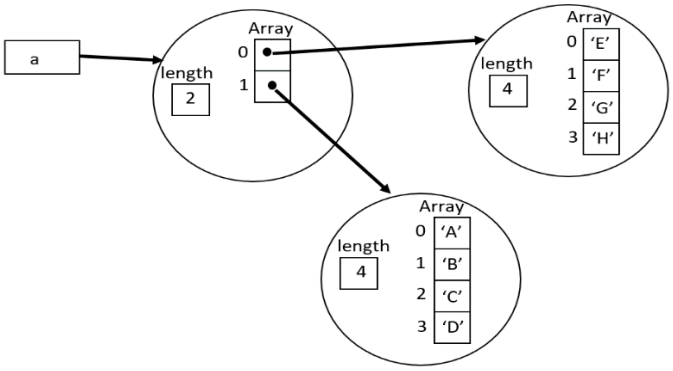
iii. Give a possible Java declaration for the 2D array represented by diagram below:



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Extra Answer Space:

Write the question number you are answering in the box.

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End of Section E

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