

External Assessment 2024

COMPUTER SCIENCE

ITC315118

Section **A**

Pages: 20

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.
- **Show all working out** used in deriving answers and use diagrams where appropriate.
 - **Extra space for answering** questions is included 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.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C1	/ Alpha

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
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)	

Criterion

You **must** make sure your answers address:

- Criterion 1 design, extend and improve algorithmic solutions to a range of problems.

Additional Instructions for Candidates

To be considered for a 'C' rating on a criterion, you must provide a satisfactory answer to at least the **first** question of the relevant section.

To be considered for a 'B' rating on a criterion, you must provide a satisfactory answer to at least the first **two (2)** questions of the relevant section.

To be considered for an 'A' rating on a criterion, you must provide a satisfactory answer to all **three (3)** questions of the relevant section.

Show the methods used in deriving answers.

Take care with the presentation of your answers, which should be complete and to the point.

Diagrams should be used where appropriate.

Complete sentences should be used in questions involving explanations.

You are reminded that poor handwriting, spelling and expression that make it difficult for the examiners to understand what you mean may lead to lower marks.

A spare answer page has been provided in the back of this section for you to use if required. If you use the spare answer page, you **must** indicate you have done so in your answer to that question.

Question 1

Marker use

The following **partially completed** algorithm calculates the total amount of food and drink needed for a barbeque.

The user enters in the number of people attending and the algorithm calculates the amount of food (sausages, bread) and drink (cans) to be purchased.

Notes

- There is minimum amount to be purchased for each food and drink item. You cannot purchase a single sausage, slice of bread or drink but instead you need to purchase a pack of sausages, loaf of bread or carton of drink.
- There is an allowance on how much each person is allocated to eat and drink.

The numbers on the left of the algorithm are provided for reference purposes.

1. **Initially**

2. `set sausage_per_pack = 6`

3. `set bread_slice_per_loaf = 12`

4. `set drink_per_carton = 24`

5. `set sausage_allowance = 2`

6. `set bread_slice_allowance = 2`

7. `set drink_allowance = 1`

8.

9. **When a number is entered into the "Number of People Attending BBQ" textfield**

10. `set people_attending to value in "Number of People Attending BBQ" textfield`

11. `display people_attending`

12. **When the "calculate" button is pressed**

13. `set packs_of_sausages =
(people_attending * sausage_allowance) / sausages_per_pack`

14. `set loaves_of_bread =
(people_attending * bread_slice_allowance) / bread_slice_per_loaf`

Question 1 continues

Question 1 continued

Marker use

```
15.     set cartons_of_drinks =  
        (people_attending * drink_allowance) / drink_per_carton
```

16.

```
17.     display "Your order contains:"
```

```
18.     "Packs of Sausages: " packs_of_sausages
```

```
19.     "Loaves of Bread: " loaves_of_bread
```

```
20.     "Cartons of Drink: " cartons_of_drinks
```

a) i. What is the minimum number of sausages that need to be purchased?

Circle the right answer.

1

6

24

20

ii. Which variable would need to increase if each person attending was now allowed 3 sausages each?

Circle the right answer.

sausage_count

sausage_pack

sausage_allowance

people_attending

b) i. How many packs of sausages do you need for one loaf of bread, given one sausage per slice?

Circle the right answer.

1

2

3

4

ii. If there were 96 people attending the barbeque, how many cartons of drink are needed?

Circle the right answer.

10

6

5

4

Question 1 continues

c) The algorithm has now been changed as per the below:

The numbers on the left of the algorithm are provided for reference purposes.

```
1. When a number is entered into the "Number of People Attending BBQ" textfield
2.     set people_attending to value in
   "Number of People Attending BBQ" textfield
3.     if people_attending < 6
4.         display "Warning"
5.         display "Please enter a valid number of people
   attending the BBQ"
6.         clear "Number of People Attending BBQ" textfield
7.     if people_attending > 100
8.         display "Warning"
9.         display "Please enter a valid number of people
   attending"
10.        clear "Number of People Attending BBQ" textfield
11.    else
12.        display "You have entered a valid number of people"
13.        display people_attending
14.    endif
```

What would you change the wording in the **"Warning"** message to, so that the user fully understands the conditions set?

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Question 1 continued

Marker use

d) The returned answer for how many packs of sausages, loaves of bread and cartons of drink are required for the barbeque could be a number which includes a decimal point.

i. What would cause this situation?

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ii. What would you need to do to purchase the correct amounts of food and drink?

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Question 2

Marker use

The following partially completed algorithm calculates the approximate cost of a gym membership. There is an initial joining fee, a membership duration fee, and further costs for extras.

The numbers on the left of the algorithm are provided for reference purposes.

1. Initially

```
2. // Joining Fee
3. set joining_fee_12hr_access = 25
4. set joining_fee_24hr_access = 50
5.
6. // Membership Duration
7. set membership_1week = 15
8. set membership_1month = 50
9. set membership_3month = 140
10. set membership_6month = 250
11. set membership_12month = 450
12.
13. // Extras
14. set locker_hire = 100
15. set towel_hire = 100
16. set key_hire = 50
17.
18. When value selected from "Joining Fee" dropdown
19. set joining_fee to value in "Joining Fee" dropdown
20.
21. When value selected from "Membership Duration" dropdown
22. set membership_duration to value in "Membership Duration"
    dropdown
23.
24. When value selected from "Extras" dropdown
25. set extras_fee to value in "Extras" dropdown
26.
27. When the "calculate" button is pressed
28. set total_cost =
    joining_fee + membership_duration + extras_fee
29. display total_cost
```

Question 2 continues

Question 2 continued

Marker use

a) There is an issue with the calculator in that only one of the extras can be selected.

Rewrite this section of the algorithm so that a user can select all three extras and have a new total displayed.

The numbers on the left of the algorithm are provided for reference purposes.

1. **When value selected from "Extras" dropdown**
2. set extras_fee to value in "Extras" dropdown
- 3.
4. **When "calculate" button is pressed**
5. set total_cost =
 joining_fee + membership_duration + extras_fee
6. display total_cost

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Question 2 continues

Question 2 continued

Marker use

The original algorithm has been changed so that a user can enter a coupon to reduce the overall cost of the membership by a set percentage.

The numbers on the left of the algorithm are provided for reference purposes.

1. Initially

- 2.
3. // Joining Fee
4. set joining_fee_12hr_access = 25
5. set joining_fee_24hr_access = 50
- 6.
7. // Membership Duration
8. set membership_1week = 15
9. set membership_1month = 50
10. set membership_3month = 140
11. set membership_6month = 250
12. set membership_12month = 450
- 13.
14. // Extras
15. set locker_hire = 100
16. set towel_hire = 100
17. set key_hire = 50
- 18.
19. // Coupons
20. set coupon_code = 123
21. set coupon_percentage = 15
- 22.
23. **When value selected from "Joining Fee" dropdown**
24. set joining_fee to value in "Joining Fee" dropdown
25. **When value selected from "Membership Duration" dropdown**
26. set membership_duration to value in "Membership Duration" dropdown
27. **When value selected from "Extras" dropdown**
28. set extras_fee to value in "Extras" dropdown

Question 2 continues

Question 2 continued

Marker use

```
28. When value entered from "Enter Coupon" textfield
29.   set coupon_value to value in "Enter Coupon" textfield

30. When "calculate" button is pressed
31. if coupon_value = coupon_code
32.   set initial_cost =
      (joining_fee + membership_duration + extras_fee)
33.   set discount_total = (coupon_percentage/100) * initial_cost
34.   set total_cost_with_coupon = initial_cost - discount_total
35.   display total_cost_with_coupon
36. else
37.   display initial_cost
38. endif
```

b) What is the logical error with this new part of the algorithm?

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Question 2 continued

Marker use

- c) A patron has requested to pay for the gym one visit at a time with 24-hour access. She can hire a towel and a locker during the day (6am – 6pm), or only a security key to use at night (6.01pm – 5.59am).

As it is now not needed, the extras dropdown option has been removed from the GUI but the hire prices remain the same.

Modify the algorithm below to enable:

- the user to enter in a valid time
- the system to display an error message if a valid time was not inputted
- the system to display the total cost for a particular time.

The numbers on the left of the algorithm are provided for reference purposes.

1. Initially

```
2. // Joining Fee
3. set joining_fee_12hr_access = 25
4. set joining_fee_24hr_access = 50
5.
6. // Membership Duration
7. set membership_1visit = 5
8. set membership_1week = 15
9. set membership_1month = 50
10. set membership_3month = 140
11. set membership_6month = 250
12. set membership_12month = 450
13.
14. // Extras
15. set locker_hire = 100
16. set towel_hire = 100
17. set security_key_hire = 50
18. When value selected from "Joining Fee" dropdown
19. set joining_fee to value in "Joining Fee" dropdown
```

Question 2 c) continues

Question 3

Parents have organised a scavenger hunt for their children and have hidden a variety of treasures to find. A prize is awarded to whoever scores the most points by finding valued treasure. Up to three individual treasures found can be entered. The parents want you to design a calculator to record details and decide a winner.

Scoring

(1) Treasure Points

- Points are allocated based on the **type** and **size** of treasure as per Table 1.
- Points for up to **three** treasures found are added together to give “Treasure Points”.

Treasure Points Table

Type	Ball	Coin	Marble
	10 pts	20 pts	30 pts
Size	Small	Medium	Large
	5 pts	8 pts	11 pts

Table 1

- **Example:** If a child finds a Small Coin, they will receive 25 points (5 + 20).

(2) Bonus Points

Bonus points are given if the **exact same treasure** is found more than once.

For example: 2 medium size coins or 3 small size marbles. Bonus points are calculated as per Table 2.

Same Treasures	Bonus Points
2	20% of Treasure Points
3	30% of Treasure Points

Table 2

NOTES:

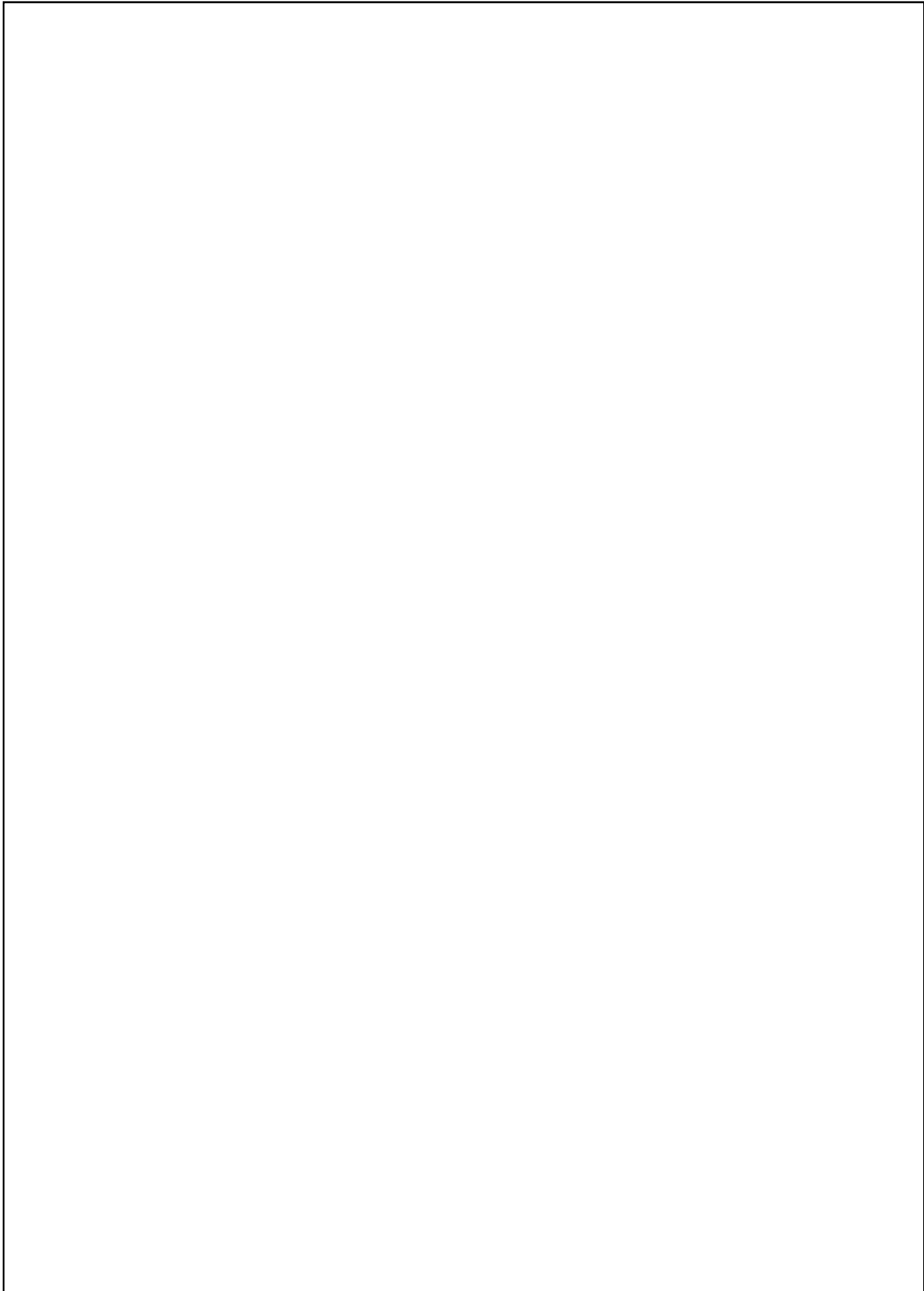
- The child’s first name, the number, type and size of each treasure found are entered in by the user.
- The number of treasures returned, and final scores need to be calculated by the app.
- Final Score is calculated by adding together Treasure Points and Bonus Points.
- If there are no bonus points awarded, a message explaining this is to be displayed.
- The child’s first name, number of treasures found, number of same treasures returned, and final score need to be displayed at the end of the calculations.

Question 3 continues

Question 3 continued

Marker use

- a) Design a possible interface for this algorithm, identifying all the textfields and/or buttons to be used.



Question 3 continues



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COMPUTER SCIENCE

ITC315118

Section **B**

Pages: 20

Questions: 3

Information Booklet: 1

Suggested working time: 36 minutes

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Marker use	
C2	/ Alpha

Guide to Exam Structure

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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)	

Criterion

You **must** make sure your answers address:

- Criterion 2 create programs in a high-level programming language.

Additional Instructions for Candidates

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Question 4

Marker use

- a) i. What will the value of **a** be after the following code is executed?

```
int x = 3;
int y = 4;
int a = x + y;
```

Circle the correct answer.

7 12 1 -1

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

```
double a,b,c;
a = 10.0;
b = 7.0*a - 6.0;
c = Math.sqrt(b);
```

Circle the correct answer.

7.0 1.0 8.0 8

- b) i. What will the value of **b** be after the following code is executed?

```
int b;
String m = "Computer Science";
b = m.length();
```

Circle the correct answer.

15 16 Computer Science 2

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

```
String c;
String m = "The Computer Science Exam";
c = m.substring(4);
```

Circle the correct answer.

"The" "The C" "Computer Science Exam" "Exam"

Question 4 continues

Question 4 continued

Marker use

c) What will the final value of **e** be after the following code is executed?

```
int e = 4;
if (e > 0) {
    e = e * 3;
}
if (e > 10) {
    e = e - 2;
}
```

Circle the correct answer.

12

4

9

10

d) What will the final answer of **f** be in the code below?

```
int f = 25;
for (int i = 0; i <= 9; i++)
{
    if (i > 4 && i <= 7)
    {
        f = f - 2;
    }
}
```

Circle the correct answer.

23

25

26

19

Question 4 continues

Question 4 continued

Marker use

e) There are **two (2)** different errors in the following Java code.

```
double a,b,answer;  
int 4g;  
a = 25.7;  
b = 25.0;  
answer = a + b;  
4g = (int)answer;  
if (4g > 50);  
{  
    4g = 4g + 50;  
}  
else  
{  
    4g = 4g - 50;  
}
```

Circle them and explain each error.

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Question 4 continues

Question 4 continued

Marker use

f) Trace the following code and find the final value of **i** and **z**:

```
int i, z;
for(i = 10; i <= 100; i = i+10) {
    if ((i >= 10) && (i <= 50)) {
        z = i / 2;
    }
    else {
        z = i * 2;
    }
}
```

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Question 4 continues

Question 4 continued

Marker use

g) The following description of a method has been provided. Complete the missing code using correct Java syntax. Line numbers are provided for reference only. You do not need to use all the lines.

- This method accepts one parameter labelled “inputNumber”.
- Even numbers or zero should be multiplied by 3 and have this result returned.
- Odd numbers should be doubled and have this result returned.

```
1. public int question4g(int inputNumber)
2. // the value "inputNumber" is the value passed into the method
3. {
4.     int output;
5.     ....
6.     ....
7.     ....
8.     ....
9.     ....
10.         return output;
11.     }
```

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Question 5

Marker use

a) Find the values below and give an explanation.

- i. What is the value of “charValue” after the following code is executed? Provide an explanation.

```
int intValue = 65;
char charValue = (char) intValue;
```

Value:

Explanation:

.....
.....

- ii. What is the value of “doubleValue” after the following code is executed? Provide an explanation.

```
int intValue = 42;
double doubleValue = intValue;
```

Value:

Explanation:

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.....

Question 5 continues

Question 5 continued

b) What will be the final values in secondArray? Provide an explanation.

```
double[] floatArray = {1.2,2.5,3.8,4.4,5.9};  
long[] secondArray = new long[floatArray.length];  
for (int i=0; i < floatArray.length; i++) {  
    secondArray[i] = math.round(floatArray[i]);  
}
```

Value:

Explanation:

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c) Trace the following code and find the final value of newWord.

```
String word = "HELLO";  
char[] charArray = word.toCharArray();  
for (int i=0; i<=(charArray.length - 1); i++) {  
    String newWord = new String(charArray, 0, i); }  
}
```

i	newWord

Value of newWord:

Question 6

Marker use

The questions refer to the following Java code:

```
public class GameScores {  
    // Method to print the array of scores  
    // Method to calculate the total score  
    // Method to find the highest score  
    // Method to calculate the average score  
  
    public static void main(String[] args) {  
        // Initialising an array of scores  
        int[] scores = {34, 56, 23, 89, 90, 45, 67};  
  
        // Printing the scores  
        printScores(scores);  
  
        // Calculating and printing the total score  
        int totalScore = calculateTotalScore(scores);  
        System.out.println("Total Score: " + totalScore);  
  
        // Finding and printing the highest score  
        int highestScore = findHighestScore(scores);  
        System.out.println("Highest Score: " + highestScore);  
  
        // Calculating and printing the average score  
        double averageScore = calculateAverageScore(scores);  
        System.out.println("Average Score: " + averageScore);  
    }  
}
```

Question 6 continues

Question 6 continued

Marker use

a) i. Write the method “printScores” to print the scores.

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ii. Write the method “calculateTotalScore” to calculate the total score.

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Question 6 a) continues

Question 6 a) continued

Marker use

iii. Write the method “findHighestScore” to find the highest score.

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iv. Write the method “findAverageScore” to find the average scores.

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Question 6 continues

Question 6 continued

Marker use

- b) The following method is now added to the original code. Trace the method and explain its purpose.

```
public int mysteryOperation (int[] scoreArray){
    for (int i = 0; i < scoreArray.length - 1; i++) {
        int index = i;
        for (int j = i + 1; j < scoreArray.length; j++) {
            if (scoreArray[j] < scoreArray[index]) {
                index = j;
            }
        }
        int smallerNumber = scoreArray[index];
        scoreArray[index] = scoreArray[i];
        scoreArray[i] = smallerNumber;
    }

    int n = scoreArray.length;
    if (n % 2 == 0) {
        return (scoreArray[n / 2 - 1] + scoreArray[n / 2]) / 2.0;
    }
    else {
        return scoreArray[n / 2];
    }
}
```

Question 6 b) continues

End of Section B

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Marker use	
C3	/ Alpha

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Criterion

You **must** make sure your answers address:

- Criterion 3 use appropriate objects in the design of programs.

Additional Instructions for Candidates

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Question 7

Marker use

This question relates to the class definition below. Each object of the Class Athlete will store firstname, surname, age and gender.

```
public class Athlete
{
    private String firstname;
    private String surname;
    private int age;
    private String gender;
    private int medal;

    public Athlete(String newFirstname, String newSurname, int newAge,
String newGender)
    {
        firstname = newFirstname;
        surname = newSurname;
        age = newAge;
        gender = newGender;
    }

    public void setFirstname(String newFirstname)
    {
        firstname = newFirstname;
    }

    public String getFirstname()
    {
        return firstname;
    }
}
```

Question 7 continues

Question 7 continued

Marker use

```
public void setSurname(String newSurname)
{
    surname = newSurname;
}
public String getSurname()
{
    return surname;
}

public void setAge(int newAge)
{
    age = newAge;
}

public int getAge()
{
    return age;
}
}
```

a) i. How many methods are included in the Class Athlete?

Circle the correct answer.

3 6 7 1

ii. How many methods in Class Athlete return a value?

Circle the correct answer.

0 1 2 3

Question 7 continues

Question 7 continued

Marker use

- b) i. Which of the following statements will create an Athlete object?

Circle the correct answer.

```
Athlete a = new Athlete("Mary", "Jones", "Twenty", "Female");
```

```
Athlete a = new Athlete(Mary, Jones, Twenty, Female);
```

```
Athlete a = new Athlete("Mary", "Jones", 20, "Female");
```

```
Athlete a = new Athlete("Mary", "Jones", "20", "Female");
```

- ii. An overload constructor is now to be used to accept the surname and age of an athlete. What would this special method definition look like?

Circle the right answer.

```
public Athlete(String newSurname, int newAge)
```

```
Athlete(newSurname, newAge)
```

```
public Athlete(newSurname, newAge)
```

```
public Athlete(int newSurname, String newAge)
```

Question 7 continues

Question 7 continued

Marker use

- c) Assume athlete1 is an Athlete object that has been declared and instantiated. It has the initial values of "Tim", "Smith", 23, "Male".

Write code which will access the object and change the surname from "Smith" to "Jones" and the age from 23 to 25.

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- d) Write a setMedals method in the class definition to assign new medals to an athlete.

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Question 7 continues

Question 8

Marker use

The following class is used to keep track of book details:

```
public class Book {
    private int bookID;
    private String title;
    private String author;
    private int publicationYear;
    private int copiesSold;

    public Book(int newBookID, String newTitle, String newAuthor,
int newPublicationYear) {
        bookID = newBookID;
        title = newTitle;
        author = newAuthor;
        publicationYear = newPublicationYear;
    }

    public String getBookID() {
        return bookID;
    }

    public String getTitle() {
        return title;
    }

    public String getAuthor() {
        return author;
    }
}
```

Question 8 continues

Question 8 continued

Marker use

```
public int getPublicationYear() {
    return publicationYear;
}

// Method to display the book's details
public void displayDetails() {
    System.out.println("Book ID: " + bookID);
    System.out.println("Title: " + title);
    System.out.println("Author: " + author);
    System.out.println("Publication Year: " +
        publicationYear);
}
}
```

- a) i. Using this class definition, write code to declare and instantiate two objects named "book1" and "book2" with the following attributes:

Book1:

Book ID	1
Title	Cloudstreet
Author	Tim Winton
Publication Year	1991

Table 3

Book 2:

Book ID	2
Title	True History of the Kelly Gang
Author	Peter Carey
Publication Year	2000

Table 4

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Question 8 continues

Question 8 continued

Marker use

ii. Write code which would display the details of the object "book1":

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b) The "AuthorCountry" is now to be included with all other details about a book. Write an overload constructor which includes this information.

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Question 8 continues

Question 8 continued

Marker use

c) The following code is now added.

```
Book[][] bookArray = new Book[2][2];  
  
    bookArray[0][0] = new Book(3, "My Brilliant Career",  
"Miles Franklin", 1901, "Australia");  
  
    bookArray[0][1] = new Book(4, "The Harp in the South",  
"Ruth Park", 1948, "Australia");  
  
    bookArray[1][0] = new Book(5, "Voss", "Patrick White",  
1957, "Australia");  
  
    bookArray[1][1] = new Book(6, "Picnic at Hanging Rock",  
"Joan Lindsay", 1967, "Australia");
```

Explain in detail what this code does.

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d) What would you need to create to display the details of the new books on the screen? Explain your answer.

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Question 9

Marker use


In a game of Australian Rules Football, a team can score either a Goal (worth six points) or a Behind (worth one point).

The team with the highest number of total points wins the game.

A live score recording application is depicted in Figure 1.

A user first selects a team from the dropdown and then presses the “Goal” or “Behind” button to increase the respective tally by one.

They could alternatively press the “Score” button where the total points are calculated, and the “Total” is updated for both teams.



The image shows a wireframe of an AFL Scoreboard application. At the top center is the title "AFL Scoreboard". Below the title is a "Select Team" label above a dropdown menu with "Dropdown..." and a downward arrow. Underneath the dropdown are three buttons: "GOAL", "BEHIND", and "SCORE". At the bottom of the interface is a rounded rectangle containing two lines of text: "Team 1 - Goals:0, Behinds:0, Total: 0" and "Team 2 - Goals:0, Behinds:0, Total: 0".

Figure 1: Picture of AFL Scoreboard.

Question 9 continues

Question 9 continued

Marker use

A class, “**AppGUI**” is already written and handles the GUI where:

- “AppGUI.selectedTeam()” returns the team selected by the user from the dropdown.
- “AppGUI.buttonChoice()” returns the button pressed: Goal, Behind or Score.

A class, “**AFLScoreboard**” is required to be written to record Goals and Behinds and display the Score.

The information to be stored in the **AFLScoreboard** class is:

Variable Name	Description	Type of Data
team1Goals	Number of Goals for Team 1	integer
team1Behinds	Number of Behinds for Team 1	integer
team2Goals	Number of Goals for Team 2	integer
team2Behinds	Number of Behinds for Team 2	integer
team1Name	Name of Team 1	String
team2Name	Name of Team 2	String

Table 5

The class will contain the following constructor and methods:

- A **constructor** that will:
 - set initial values for team1Goals, team1Behinds, team2Goals, team2Behinds to initially be 0
 - accept the names of the two teams that are playing the game
- A **method** to add a goal for the active team
- A **method** to add a behind for the active team
- A **method** for calculating the total score for a team
- A **method** for displaying the full details of each team

A class, “main” is required to create an instance of a new **AFLScoreboard** and handle the button presses by the user.

- a) Write the **AFLScoreboard** class definition, constructor, and general methods for this application.
- b) Write a “main” class which will create an instance of an **AFLScoreboard** with team1 set as “Burnie” and team2 as “Hobart” and also handles the button actions.

Question 9 continues

End of Section C
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COMPUTER SCIENCE

ITC315118

Section **D**

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.
- **Show all working out** used in deriving answers and use diagrams where appropriate.
 - **Extra space for answering** questions is included 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.
- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C4	/ Alpha

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
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)	

Criterion

You **must** make sure your answers address:

- Criterion 4 describe and apply knowledge of computer architecture.

Additional Instructions for Candidates

To be considered for a 'C' rating on a criterion, you must provide a satisfactory answer to at least the **first** question of the relevant section.

To be considered for a 'B' rating on a criterion, you must provide a satisfactory answer to at least the first **two (2)** questions of the relevant section.

To be considered for an 'A' rating on a criterion, you must provide a satisfactory answer to all **three (3)** questions of the relevant section.

Show the methods used in deriving answers.

Take care with the presentation of your answers, which should be complete and to the point.

Diagrams should be used where appropriate.

Complete sentences should be used in questions involving explanations.

You are reminded that poor handwriting, spelling and expression that make it difficult for the examiners to understand what you mean may lead to lower marks.

A spare answer page has been provided in the back of this section for you to use if required. If you use the spare answer page, you **must** indicate you have done so in your answer to that question.

Question 10

a) i. Select the logic expression which represents Figure 2.

/2

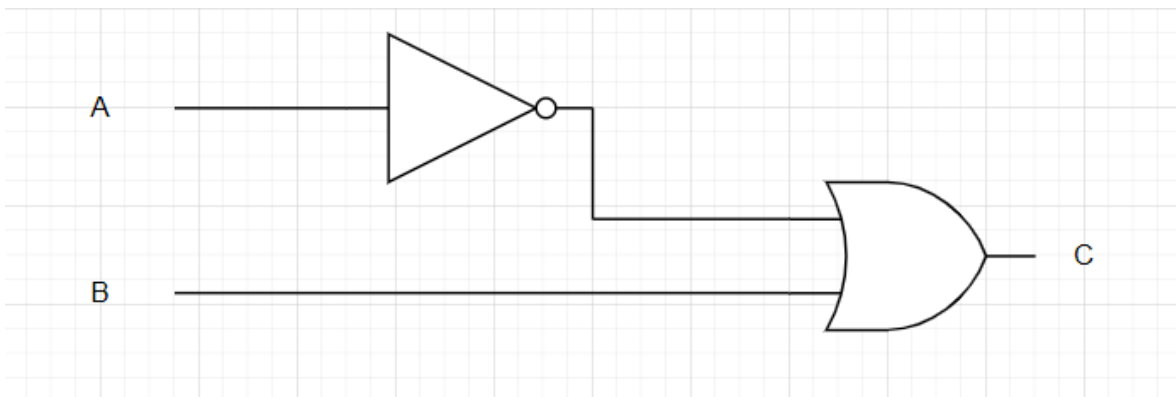


Figure 2: Picture of logic expression.

Circle the correct answer.

$A \vee B \equiv C$

$\sim A \vee B \equiv C$

$\sim A \wedge B \equiv C$

$B \vee C \equiv C$

ii. Select the logic expression which represents Figure 3.

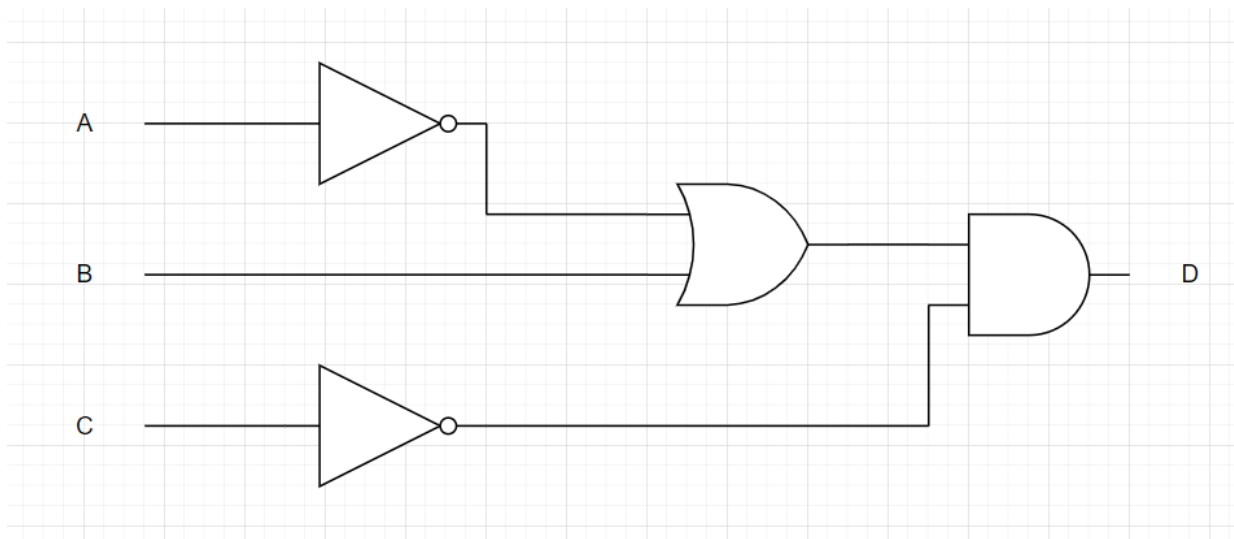


Figure 3: Picture of logic expression.

Circle the correct answer.

$(\sim A \vee B) \wedge \sim C \equiv D$

$\sim A \vee \sim B \wedge C \equiv D$

$A \wedge B \wedge C \equiv D$

$(\sim A \wedge B) \vee \sim C \equiv D$

Question 10 continues

Question 10 continued

Marker use

b) Draw the logic circuit for D:

$$D \equiv (A \wedge B) \vee (B \wedge C)$$

c) i. Complete Table 6, then circle the corresponding table out of Tables 7 – 10.

A	B	$\sim A \wedge \sim B$
F	F	
F	T	
T	F	
T	T	

Table 6

$\sim A \wedge \sim B$
F
T
T
T

Table 7

$\sim A \wedge \sim B$
F
F
F
F

Table 8

$\sim A \wedge \sim B$
F
F
F
T

Table 9

$\sim A \wedge \sim B$
T
F
F
F

Table 10

Question 10 continues

Question 10 continued

ii. Complete the logic expression for the following truth table:

A	B	F
0	0	1
0	1	1
1	0	0
1	1	1

Table 11

$F \equiv$

d) For the following logic expression:

$$(A \wedge A) \vee (A \wedge C)$$

i. Simplify the logic expression and show your answer.

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ii. State the logic laws used in your simplification.

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Question 10 continues

Question 10 continued

e) Complete the truth table for the following expression.

$$\sim(A \wedge B) \wedge \sim(A \vee B)$$

A	B	$A \wedge B$	$\sim(A \wedge B)$	$A \vee B$	$\sim(A \vee B)$	$\sim(A \wedge B) \wedge \sim(A \vee B)$
0	0					
0	1					
1	0					
1	1					

Table 12

f) In Boolean Logic:

i. Explain what the purpose of a Karnaugh Map is?

.....

.....

ii. Use a Karnaugh Map to simplify the expression:

$$E \equiv (\sim A \wedge B) \vee (A \wedge B)$$

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g) i. Describe the function of a bus in a computing system?

.....

.....

.....

ii. What limitations can a bus create in a computing system?

.....

.....

Question 11

a) Produce a simple logic expression for **F** from the following Karnaugh Maps.

i.

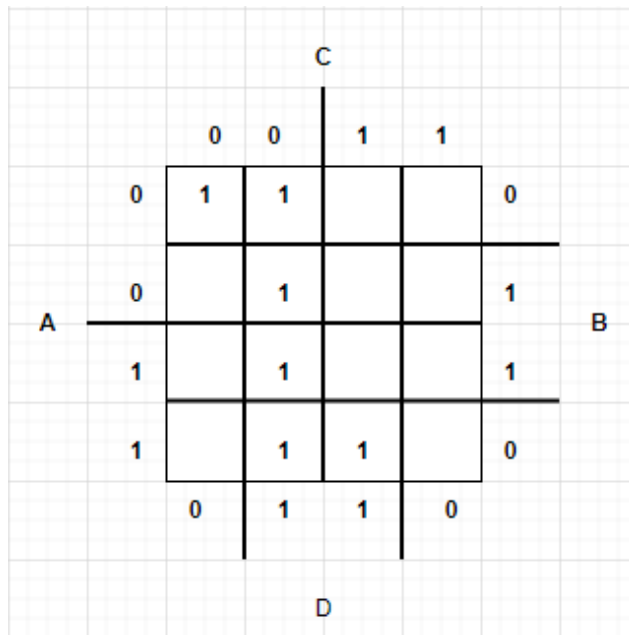


Figure 4

Simplified Expression

.....

ii.

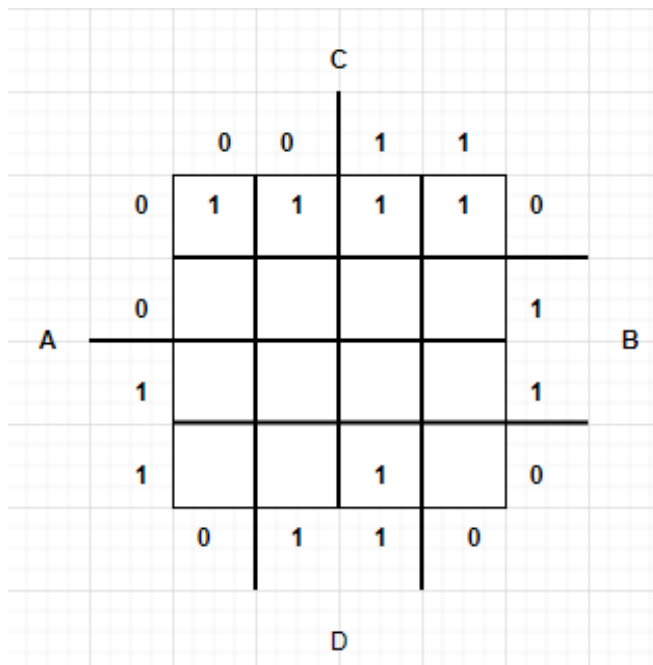


Figure 5

Simplified Expression

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Question 11 continues

Question 11 continued

Marker use

b) In a TOY machine, both a register and a memory cell can store two complement 16-bit integers. What then is the difference between a register and a memory cell?

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Question 11 continues

- c)
- i. In a TOY machine what Memory Address does the Program Counter (PC) start at?
.....
 - ii. Use Table 13 to fill in the TOY instructions, pseudocode and explanation boxes to show what each line of code does to sum the values of memory addresses [01] & [02] and store the result in memory address [03].

Memory Address	Contents	Pseudocode	Explanation
01	0008	Data	Mem[01] contains value 8
02	0005		
03	0000		
10			
11			
12			
13			
14			

Table 13

- iii. What is the final value stored in Memory Address [03]?
.....
- iv. Why isn't the register R[0] initialised?
.....

Question 12

a) Trace the following two TOY programs and determine the final content in Memory Address [03].

i.

Memory Address	Contents	Pseudocode	Explanation
01	0006	data	0000 0000 0000 0110
02	0009	data	0000 0000 0000 1001
03	0000	data	0000 0000 0000 0000
10	8101	R[1] f mem[01]	Set Register 1 to the contents of memory location 01
11	8202	R[2] f mem[02]	Set Register 2 to the contents of memory location 02
12	3312	R[3] f R[1]& R[2]	Set Register 3 to Register 1 AND Register 2
13	9303	mem[03] f R[3]	Store Register 3 in memory location 03
14	0000	halt	

Table 14

PC	R[1]	R[2]	R[3]

Table 15

Memory Address 03:

Question 12 continues

ii.

Memory Address	Contents	Pseudocode	Explanation
01	000C	data	0000 0000 0000 1100
02	0002	data	0000 0000 0000 0010
03	0000	data	0000 0000 0000 0000
10	8101	R[1] f mem[01]	Set Register 1 to the contents of memory location 01
11	8202	R[2] f mem[02]	Set Register 2 to the contents of memory location 02
12	6312	R[3] fR[1] << R[2]	Set Register 3 to Register 1 left shifted by the value in Register 2
13	9303	mem[03] f R[3]	Store Register 3 in memory location 03
14	0000	halt	

Table 16

PC	R[1]	R[2]	R[3]

Table 17

Memory Address 03:

Question 12 continued

b) Examine the TOY program below:

Memory Address	Contents	Pseudocode	Explanation
00	0000	Data	The variable a
01	0000	Data	The variable b
10	8A00	$R[A] \leftarrow \text{mem}[00]$	Set Register A to the contents of location 00
11	7103	$R[1] \leftarrow 03$	Set Register 1 to the number 03
12	2CA1	$R[C] \leftarrow R[A] - R[1]$	Register C = Register A – Register 1
13	DC15	if $R[C] > 0$ pc \leftarrow 15	Branch to address 15 if Register C > 0
14	C01B	If $R[0] == 0$ pc \leftarrow 1B	1B Branch to address 1B
15	7105	$R[1] \leftarrow 05$	Set Register 1 to the number 05
16	2C1A	$R[C] \leftarrow R[1] - R[A]$	Register C = Register 1 – Register A
17	DC19	if $R[C] > 0$ pc \leftarrow 19	Branch to address 19 if Register C > 0
18	C01B	If $R[0] == 0$ pc \leftarrow 1B	Branch to address 1B
19	7B02	$R[B] \leftarrow 02$	Set Register B to the number 02
1A	9B01	$\text{mem}[01] \leftarrow R[B]$	Store Register B in location 01
1B	0000	Exit	End of Program

Table 18

Write down the equivalent code segment in Java.

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Question 12 continues



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COMPUTER SCIENCE

ITC315118

Section **E**

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.
- **Show all working out** used in deriving answers and use diagrams where appropriate.
 - **Extra space for answering** questions is included at the end of the section. If used, you **must** indicate you have done so next to the relevant question.
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- The exam is **three (3) hours** in length. The suggested working time for this section is **approximately 36 minutes**.
- All answers must be written in **English**.
- You **must** make sure your answers address the listed criterion.

Marker use	
C5	/ Alpha

Guide to Exam Structure

	Questions available	Questions to answer	Suggested working time	Marks available
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)	

Criterion

You **must** make sure your answers address:

- Criterion 5 analyse how data are represented and stored.

Additional Instructions for Candidates

To be considered for a 'C' rating on a criterion, you must provide a satisfactory answer to at least the **first** question of the relevant section.

To be considered for a 'B' rating on a criterion, you must provide a satisfactory answer to at least the first **two (2)** questions of the relevant section.

To be considered for an 'A' rating on a criterion, you must provide a satisfactory answer to all **three (3)** questions of the relevant section.

Show the methods used in deriving answers.

Take care with the presentation of your answers, which should be complete and to the point.

Diagrams should be used where appropriate.

Complete sentences should be used in questions involving explanations.

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Question 13

Marker use

a) i. When 79_{10} is converted into **unsigned binary** the correct answer is:

Circle the correct answer and show any working out.

0110000_2

1001111_2

1111000_2

0111110_2

Working:

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.....

ii. When $1100\ 0001_2$ is converted into **decimal** the answer is:

Circle the correct answer and show any working out.

3_{10}

193_{10}

192_{10}

-193_{10}

Working:

.....

.....

b) i. When $1AC_{16}$ is converted into **decimal** the answer is:

Circle the correct answer and show any working out.

-428_{10}

444_{10}

428_{10}

1428_{10}

Working:

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Question 13 continues

Question 13 continued

Marker use

ii. When 1011.10101 is converted from **binary to decimal** the answer is:

Circle the correct answer and show any working out.

11.65625₁₀

11.30000₁₀

11.21000₁₀

11.65600₁₀

Working:

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.....

c) i. What is the sum of 10101010₂ and 01011010₂?

Circle the correct answer and show any working out.

1 0000 0100₂

1000 0100₂

0 0000 0100₂

0 1111 1011₂

Working:

.....

.....

ii. What is the ASCII code (**in decimal**) for the character 'f'?

Circle the correct answer.

70₁₀

46₁₀

66₁₀

102₁₀

Question 13 continues

Question 13 continued

Marker use

- d) One of the numbers below represents a positive number in 8-bit two's complement.
Circle the correct answer and fully explain the makeup of this number.

1010 0101₂

1000 1000₂

1111 0000₂

0001 1100₂

Explanation:.....

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- e) Using 8-bit two's complement representation, what is the largest positive integer that can be represented?

Explain your reasoning.

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Question 14

Marker use

- a) Explain what happens if you add -60 and -75 using two's complement with an 8-bit word length.

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- b) Perform the following two's complement arithmetic using 8 bits: $56 - 12$.

Show working out.

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Question 14 continues

Question 14 continued

Marker use

- c) An operation that can be used on a register is the “Right Shift”. This moves all bits to the right and places a zero in the most significant bit.

Using the illustration (Figure 6) provided as an example, explain what effect this has on the value stored in the register for this unsigned binary number.

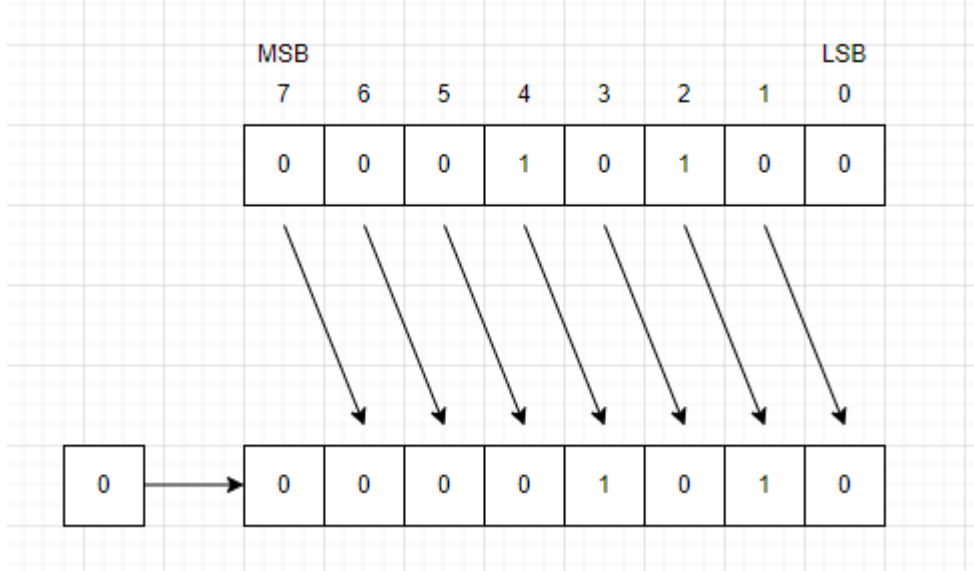


Figure 6

Explanation:

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- d) Convert 0.011001_2 to **decimal**.

Show all working out.

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Question 15

Marker use

- a) A sixteen-bit word is used to store floating point numbers as shown in Table 20.
- Bits M0 to M7 store the mantissa
 - Bits E0 to E5 store the exponent
 - The exponent sign bit use '1' to represent '-' and '0' for '+'
 - The mantissa sign bit use '1' to represent (-) and '0' for '+'.

What **decimal** number is represented below? Show all working out.

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

Table 20

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- b) A mobile phone’s camera sensor uses a filter overlay to record colours. As semiconductors do not “see” colours, without a filter you would get a black and white photo.

In high-end mobile phones, a technique called “Binning” is used. Binning is possible using a “quad-bayer filter”. For a typical mobile phone sensor, the quad-bayer filter would record 16 Blue, 16 Red and 32 Green colour squares of information to represent each pixel. The filter uses the range: 0 to 8,120 for these values for each square.

Determine the number of bits in a RAW file for an image of 640 * 480 pixels.

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Question 15 continues

Question 15 continued

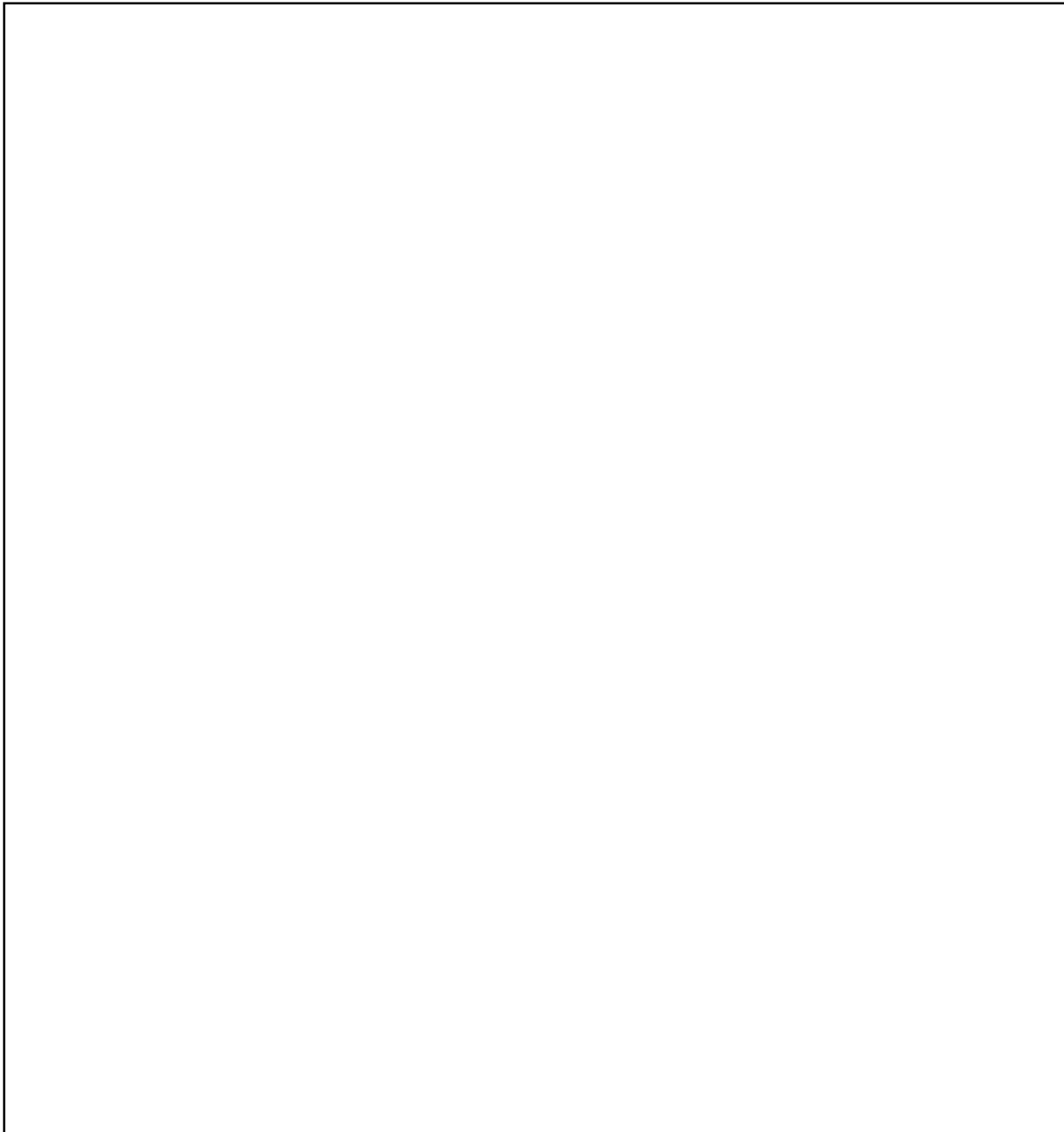
Marker use

c) An array is declared and instantiated as follows:

```
int [ ][ ] a = new int [3][2];
```

- i. Draw a diagram representing the array that shows a link between all its components.
- ii. Draw in the diagram the effect of the following Java statement:

```
a[2][1] = 9;
```



Question 15 continues

Question 15 continued

iii. The array has now been initialised with the following values:

a[0][0]	1
a[0][1]	2
a[1][0]	4
a[1][1]	5
a[2][0]	7
a[2][1]	9

Table 21

The variable **a** holds the base address of the memory location that contains the length of the array. The memory locations after this address contain the contents of the array or references back to other memory locations.

Using the memory map below, fill in the values needed to show how the above array could be stored in the memory of a computer.

Memory Address	Content
AC00	
AC01	
AC02	
AC03	
AC04	
AC05	
AC06	
AC07	
AC08	
AC09	
AC0A	
AC0B	
AC0C	

Table 22

End of Section E
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