

IBDP Computer science

Standard level

NAME

Year 11 - End of Semester 2

1 hour 45 minutes

Instructions to candidates

- Do not open this examination paper until instructed to do so.
- Section A: answer all questions.
- Section B: answer all questions.
- The maximum mark for this examination paper is **[75 marks]**.

Section A

Answer **all** questions.

1. Outline what is meant by the term computer network.

[2]

2. (a) State 2 methods of implementing a new system.

[2]

- (b) Outline **one** advantage of using beta testing prior to the release of a new product.

[2]

3. Surveying users is a technique used by a system analyst to determine user requirements for updating a computer system.

- (a) Identify **one** advantage of surveying users.

[1]

- (b) Identify **one** disadvantage of surveying users.

[1]

4. Construct a logic diagram for the following expression.

A OR (A AND NOT B)

[3]

5. An international company is in the process of moving its Head Office from Europe to Asia.

(a) The company uses a VLAN. Outline one advantage of using a VLAN over a LAN.

[2]

(b) Outline how a virtual private network (VPN) will allow employees who are in Europe to communicate with the Head Office in Asia.

[2]

(c) Outline **one** social issue associated with this process.

[2]

6. Describe how data is transmitted by packet switching.

7. Construct a trace table for the following algorithm

[4]

```
A = 3
B = 10
loop while B >= A
    A = A + B
    output(A)
    B = B - 2
end loop
```

[4]

8. (a) (i) Distinguish between random access memory (RAM) and read only memory (ROM).

- (ii) State 2 functions of an operating system.

[3]

[2]

- (b) Explain the roles of the data bus and the address bus in the machine instruction cycle.

[4]

- (c) (i) State how the data stored in the following byte will be represented in hexadecimal.

0	1	0	1	0	1	1	1
---	---	---	---	---	---	---	---

[1]

- (ii) State how many integers could be represented in this byte.

[1]

- (iii) Outline why this byte could not be used to represent characters such as those used in Chinese.

[2]

- (d) Construct a truth table with two input variables. If the input variables are equal the value of the output variable should be True, otherwise it should be False.

9. (a) Outline the need for higher level languages such as Python and Java (as opposed to low level languages like machine code). [2]

- (b) Explain **two** benefits of using sub-procedures within a computer program. [2]

[4]

Collection `NUMBERS` already exists and stores real numbers.

- (c) Construct in pseudocode an algorithm, using the access methods of a collection, which will iterate through the collection `NUMBERS` and count how many elements stored in the collection are in the interval $[-1,1]$.

The final answer should be output.

10. The following method, `calcBMI()` accepts person's height (H) in metres (m) and weight (W) in kilograms (kg) and returns their Body Mass Index (BMI).

```
calcBMI(H, W)
    X = H * H
    B = W / X
    return B
endcalcBMI
```

Boris weighs 104kg and is 2.00m tall. His BMI can be calculated by calling method `calcBMI()` as follows

```
BorisBMI = calcBMI(2.00, 104).
```

- (a) State the value of variable `BorisBMI`.

[1]

The data about a group of adults and their height measurement (in metres) and weight measurement (in kg) is held in three one-dimensional arrays.

	NAME		WEIGHT (kg)		HEIGHT (m)
[0]	Annie	[0]	52.40	[0]	1.56
[1]	Boris	[1]	100.00	[1]	2.00
[2]	Hugh	[2]	105.00	[2]	2.03
[3]	Paul	[3]	61.00	[3]	1.75
[4]	Robby	[4]	88.00	[4]	1.80
...	...	...	...	...	...
...	...	...	...	...	...
[29]	Zara	[29]	68.00	[29]	1.71

Where

`NAME` is a one-dimensional array holding names (currently sorted in alphabetical order).

`WEIGHT` is a one-dimensional array holding weight measurement in kilograms.

`HEIGHT` is a one-dimensional array holding height measurement in metres.

For example,

`NAME[0]` is Annie.

Her weight measurement is 52.40kg and can be found in `WEIGHT[0]`.

`HEIGHT[0]` is 1.56 which represents Annie's height measurement in metres.

(Question 10 continued)

- (b) State the name of the person whose height is held in `HEIGHT[3]`.

[1]

- (c) (i) Identify **one** reason why a binary search algorithm cannot be used to find the name of person whose height is given.

[1]

- (ii) Describe how the name of person whose height is given could be output.

[2]

- (d) Construct an algorithm in pseudocode which will output the names of all the people whose BMI is greater than this group's average BMI.

You should call method `calcBMI()` in your answer.

[6]

Section B - Option D

An airport uses an object-oriented program to keep track of arrivals and departures of planes. There are many objects in this system and some are listed below.

Flight	Each <code>Flight</code> has many attributes including a unique ID code.
Arrival	In addition to a variable of the type <code>Flight</code> , each <code>Arrival</code> has a Scheduled Time of Arrival (STA) in 24-hour format, a runway number, a gate code, a delay time (in minutes) and an indicator whether the airplane has landed.
FlightManagement	The main class that manages the arrival and departure of all flights.

The code below outlines the `Arrival` class used in this program.

```
public class Flight
{
    private String id;
    public String getId() {return this.id;}
    // ... more variables, accessor and mutator methods
}

public class Arrival
{
    private Flight myFlight;
    private String sta;           // Scheduled Time of Arrival ("hh:mm")
    private int runway;
    private String gate;
    private int delay;
    private boolean landed;

    public Arrival(Flight myFlight, String sta)
    {
        this.myFlight = myFlight;
        this.sta = sta;
        this.runway = 0;
        this.gate = null;
        this.delay = 0;
        this.landed = false;
    }

    public void addDelay(int newDelay)
    {
        this.delay = newDelay;
    }

    public String getETA()
    {
        // calculates the Estimated Time of Arrival (ETA) of the flight
        // by adding the delay to the sta and returning the result as a
        // String ("hh:mm")
    }

    public int compareTo(String flightID)
    {
        if (myFlight.getID().equals(flightID)) { return 0; }
        else { return 1; }
    }

    public int compareTo(Arrival anotherArrival)
    {
        // missing code
    }

    // ... plus accessor and mutator methods
}
```

(Option D continues on the following page)

11 a. Construct a UML diagram to represent the `Arrival` object.

[4]

The code below outlines part of the `FlightManagement` class used in this program.

For the purposes of this exam only arriving flights are being considered.

```
public class FlightManagement
{
    private Arrival[] inbound;           // array of inbound airplanes
    private int last = -1;                // index of last used entry

    public FlightManagement()
    { inbound = new Arrival[200];
    }

    public void add(Arrival newArrival)
    { // missing code that adds the newArrival to the array inbound
      // sorted by ETA, and updates last
    }

    private int search (String flightID)
    { // missing code that searches the array inbound and
      // returns the index of the Arrival object with flightID
    }

    public Arrival remove(String flightID)
    { Arrival result;
      int index = search(flightID);
      result = inbound[index];
      while (index < last)
      { inbound[index] = inbound[index + 1];
        index++;
      }
      last--;
      return result;
    }

    // ... many more methods
}
```

The method `search` in the `FlightManagement` class searches the array `inbound` and returns the index of the `Arrival` object with the given `flightID`.

- 11 b. Construct the method `search()` implementing a linear search. Use the first `compareTo()` method in the `Arrival` object.

You may assume that an `Arrival` object with the given `flightID` exists in the array `inbound`.

[4]

- 11 c. (i) Outline **one** advantage of using a binary search.

[2]

- (ii) Outline **one** disadvantage of using a binary search.

[2]

