## 2013

## HIGHER SCHOOL CERTIFICATE

## TRIAL EXAMINATION

## Software Design \& Development

$30 \%$ Weighting

## General Instructions

- Reading time: 5 minutes
- Working time: 3 hours
- Write using black or blue pen ONLY
- Draw diagrams using pencil
- Write your Student Number on each page and booklet

Section I: Use separate answer sheet provided

Section II: Write all answers in this booklet

Section III: Write all answers in this booklet

NOTE: You will be supplied a booklet of spare paper for working out if required.

Total marks - 100

Section I [20 Marks]

- Attempt Questions 1-20
- Allow around 35 minutes for this section


## Section II [60 Marks]

- Attempt all the questions in this section
- Allow around 1 hour and 50 minutes for this section


## Section III [20 Marks]

- Attempt all the questions in this section
- Allow around 35 minutes for this section


## Section I: Multiple Choice

All questions are worth 1 Mark.

1. The value 12.0 would best be stored in:
a. An integer
b. A float
c. A string
d. An array

Consider the following piece of code:

$$
\begin{aligned}
& a=[2,0,3,4,1] \\
& x=a[a[a[3)]] \\
& \text { PRINT } x
\end{aligned}
$$

2. What will the output be of the algorithm above?
a. 0
b. 1
c. 2
d. 3

Consider the following EBNF statement:

```
<zug> = \(1|2| 3 \mid 4\)
<zag> = a|b|c|d
<zig> = <zag>\{<zug>\}
<zeg> = <zig> | <zag> [<zug><zug>]
```

3. Which of the following statements are legal for <zeg>?
a. a323d1
b. d2215a
c. a13134
d. 44 a 22
4. Convert 111 to a binary number:
a. 01000011
b. 01101111
c. 7
d. 17

Consider the following algorithm:

```
# my sort
my_list = [12, 5, 13, 8, 9, 65]
sort_algorithm(u_list)
    length = len[u_list] - 1
    sorted = False
    while not sorted:
        sorted = True
        for i in range(length):
            if u_list[i] > u_list [i+1]:
            sorted = False
            u_list [i], u_list [i+1] = u_list [i+1], u_list [i]
        end if
        next
    end while
sort_algorithm(my_list]
print my_list
```

5. The above code is an example of:
a. Binary Search
b. Bubble Sort
c. Insertion Sort
d. Selection Sort
6. A diagram is designed to specifically show the data that goes into a system, how it is processed and the data exiting a system is called a:
a. Flow chart
b. Structure Diagram
c. Storyboard
d. IPO Chart

Consider the following algorithm for question 7:

$$
\begin{aligned}
& a=3 \\
& b=4 \\
& \text { c }=1 \\
& \text { while c > a: } \\
& \text { if } b>a \text { : } \\
& c=c-1 \\
& \text { b }=\mathrm{b}-\mathrm{a} \\
& a=b-2 \\
& \text { end if } \\
& \text { end while } \\
& \text { print c }
\end{aligned}
$$

7. What is the final output and how many times does the algorithm loop through the while statement?
a. Output 1, Iterations 0
b. Output 0, Iterations 1
c. Output-1, Iterations 2
d. Output 4, Iterations 5

Consider the following algorithm:

```
some_var = arrNum[0]
for i = 0 to upper[arrNum] //iterate through each item
    if arrNum[i] > some_var then
        some_var = arrNum[i]
    end if
nexti
```

8. The above algorithm above will:
a. Find the maximum value in an array
b. Find the minimum value in an array
c. Swap two value around
d. Cause an error
9. A Gantt chart is used to help project managers:
a. Break up tasks into manageable sections
b. Schedule the priorities of tasks
c. Show resources being used in tasks
d. All of the above

Consider the following flowchart:

10. When tested with the following data $[17,30,54,45,23,50]$, what will Total be at the end of the process?
a. 30
b. 75
c. 125
d. 219
11. Testing the inputs and outputs only of a system is an example of:
a. White box testing
b. System wide testing
c. Black box testing
d. Sub-Process testing
12. A token dictionary is used during compilation to:
a. Store the data in variables
b. Show the compiler which sections of the code to ignore (like whitespace)
c. Store the language elements of the program
d. Store the instructions passed to the compiler

Consider the following code snippet:

```
MOV X,DO
MOV N,D1
MOV DO,D2
SUB #1,D1
```

13. The above example of code is most likely an example of which generation of programming languages?
a. First generation
b. Second generation
c. Third generation
d. Fourth generation

Consider the following algorithm:

```
DO
    PRINT x
    x = x-1
UNTIL x <= 10
```

14. The above algorithm above is an example of a:
a. Nested loop
b. Unguarded loop
c. Guarded loop
d. Fixed loop
15. Whilst a program is executing, where is the next instruction being stored?
a. Secondary storage
b. Primary storage
c. Registers within the CPU
d. The CPU counter
16. Someone who is playing cards and sorts their hand by choosing the next card in a set and moving it to the right position is most likely using:
a. A Bubble Sort
b. An Insertion Sort
c. A Selection Sort
d. A Binary Search

Consider the following diagram:

17. Which implementation methodology is the above diagram illustrating?
a. Direct Cut Over
b. Phased
c. Parallel
d. Pilot
18. CASE Tools are:
a. Used in the planning stages of a project only
b. Used in the design stage of a project only
c. Used in the defining, planning and testing stages of a project
d. Used throughout all stages of a project

Consider the following Railroad Diagram:

19. In the above diagram, which of the following is a legal value for floom?
a. 11 a
b. 45 bb
c. $7+7 \mathrm{a} 9 \mathrm{c}$
d. $56+92$
20. An application that can be used on different operating systems is considered to be:
a. Backward compatible
b. Forward compatible
c. Portable
d. Operationally reliable

## Secton II

## Question 21

A retail company is planning to purchase large amounts of credit card transaction histories from a bank. They are planning to use this information to customize a website based on who you are and your past purchases. The service is opt-in and will allow the user to see a highly focused set of shopping recommendations based on their profile. The intention is that it will make it easier for users to find something that they are interested in.
a) With regard to the scenario described above, analyse three social and ethical issues that will need to be taken into consideration when planning and building the service.
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b) Discuss TWO rights and responsibilities of the developer when creating any piece of software.
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## Question 22

A Science Fiction magazine is planning to move online only distribution. With this move, they wish to try some innovative new features. For example, they would like to create a customizable issue of the magazine as a PDF based on stories that the reader likes and might be interested in.

They will be moving all of their current subscribers to the online model with their current magazine stories already credited to their account.

New subscribers will get a number of credits per month to spend on stories that will be added to their account. As they purchase more stories and mark them as read and rate them an algorithm will start to compile a profile on their reading habits. This will be used to direct editors in selecting content, and also used in promotions targeting their readers.

Users will be able to spend their credits purchasing stories to add to their magazine, or they can allow the algorithm to create it for them based on their profile. If the algorithm completes the magazine for the user, the cost in credits will be halved.

Questions on next page.
a) Construct a 1st Level Data Flow Diagram of the above scenario.
b) Construct a System Flowchart for the creation of the monthly magazine and charging of credits to the user.

As the new Science Fiction magazine continues to grow, they will want to add new features to the system, like levels of membership, the ability to add your own stories to their collection and a way to print a hardbound collection of the magazine at the end of the year.
c) Compare and contrast TWO development methodologies that could be used for the above business and recommend one.
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## Question 23

Battleship is a game played across a grid of 10 by 10 squares. Each player places a number of ships across these squares of various sizes. Each player takes turns in calling out squares to the other player. If they call a square that contains a ship, they score a hit. The player who 'sinks' the opponent's ships first is the winner.

You have been tasked with creating an online version of the game of Battleship. During development an array is used to store all of the placed ships ( 9 in total). For the sake of easy testing in the early stages of development, all the ships are placed lengthwise like this:

$$
\begin{aligned}
& 0123456789 \\
& \text { 0~~~~~~~~~~ } \\
& \text { 1~~~~~~~~~~ } \\
& \text { 2~\#\#\#~~~~~~ } \\
& \text { 3~~~~~~~~~~ } \\
& \text { 4~~~~~\#\#\#\#~ } \\
& 5 \sim \sim \sim \sim \sim \sim \sim \sim \sim ~ \\
& \text { 6~~\# \#~~\#\#\#~ } \\
& \text { 7~~~~~~~~~~ } \\
& \text { 8~~~~~~~~~~ } \\
& \text { 9~~\# \# \#~~~~~ }
\end{aligned}
$$

A two-dimensional array sea_array stores each wave (" $\sim$ ") or part of a ship ("\#").
a) Compose an algorithm that will detect whether a ship is in a square or not. The input will be a number 0 to 9 twice as x and y .

If it is a hit, the output will need to be:

Coordinates $\mathrm{X}, \mathrm{Y}$ : A hit!

Otherwise:

Coordinates $\mathrm{X}, \mathrm{Y}$ : A miss!
[Answer question on next page.

As development on the Battleship game continues, a sub-routine needs to be created to show where all of the ships are for a player and display which ships have been hit and where.

An array named ship_hit is used to store the hits to ships as they occur. Hits on ships are displayed with an asterix ("*"). For example:

```
~~#**## ~~~
```

b) Construct an algorithm that will print a screen of all the ships and the hits that they have in a 10 by 10 grid. If you make any assumptions about other sub-routines or code, include them in the comments.

Complete the question on the next page.

## Question 24

A local cupcake store has proven to be very successful and is planning to grow their business. They would like to add online orders for special events to their offerings. Currently, they offer 12 varieties of cupcakes and they can do 3 different styles of icing. They can also do gluten-free cupcakes if required. For special occasions they will also allow you to do a custom message on one of the cupcakes that is 20 characters long. They also feel that it is important that a photo of each kind of cupcake is viewable when ordering.

Orders will be limited to only 3 kinds of cupcakes and delivery can be added if required.
a) Complete a screen design for the main order page that would be appropriate for the ordering process.

The twelve types of cupcakes fall into three price categories, Simple at $\$ 2$ each, Fancy at $\$ 3$ each and Super Awesome at $\$ 5$ each. The custom message will cost a further $\$ 12$. To do gluten-free cupcakes will cost an additional $\$ 1.20$ per cupcake ordered. Delivery is $\$ 25$ if required.
b) Construct an algorithm that will calculate the cost of an order.
[5 Marks]

## Question 25

Steve works in the Accounting department. His boss has asked him to consider ways that they can improve their filing of invoices. The current system includes many different paper forms that need to be passed around the various departments and heads for sign off. The boss feels that this could be much improved.

The proposal is to create a system where each form is filled out online. Once it has been completed, an alert is sent to the relevant heads of departments to approve or disapprove the invoice. The names of those who need to sign off on each form or invoice are stored in a database and the form type number will indicate who is responsible. Once all e-signatures have been collected, the form will be sent to Steve for processing.
a) Construct a Structure Diagram illustrating the system described above.
b) As the system is being built, the issue of how the system will be implemented needs to be decided upon. Outline THREE considerations when deciding on an implementation methodology.
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c) In the planning stages of the solution the IT Department wishes to make sure that they have fully understood the system as it currently works in its nondigital form. Discuss THREE methods that could be used by their Systems Analyst to make sure that they have a full understanding of current methodologies used by the company.
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## Question 26

a) List the steps in the FETCH EXECUTE cycle in order.
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b) List and describe the stages of the Structured Development Methodology.
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c) Construct a Parse Tree for the following assignment:

$$
x=9+3 * y
$$

## Section III: Option Topic

## Question 27

Consider the following Object Oriented code for describing employees in a.

```
Class Employee extends Person {
    Public {
        Int payrolIID;
        Int deptID;
        String Name;
        String Title;
        date dob;
        double salary;
    }
    Private {
    Void pay[];
    Void changeDept[];
    Void changeTitle[];
    }
}
```

The above code is to be extended to include the attributes hireDate, reportTo and yearlyBonus. The methods changeBoss(), changeHireDate() and payBonus() also need to be added.
a) Compose a child class that extends from the parent Employee class to include the listed properties and methods.
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b) Discuss two ways in which a Programming Paradigm can affect the programmer's productivity when completing a project.
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c) Compare and contrast how using Inheritance in Object Oriented Programming benefits the developer as opposed to using the Logic paradigm.
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d) Describe the process of encapsulation and how it can be used to a programmer's advantage when working on large projects with many other developers.
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$\qquad$
$\qquad$

Consider the following Prolog code used to identify who works in which department and for whom:

```
employee[steve].
employee(jill].
employee[jake].
employee[paul].
employee[duncan].
employee[michelle].
employee[dwayne].
employee(lisette].
dept[accounting, steve].
dept[accounting, jill].
dept[accounting, jake].
dept[retail, paul].
dept[retail, duncan).
dept[retail, michelle].
dept[marketing, dwayne].
dept[marketing, lisette].
boss[duncan).
boss[dwayne].
boss[steve].
worksWith[X,Y):- dept[Z,X], dept[Z,Y].
```

e) Compose a rule that will identify if an employee is the boss of a department. [2 Marks]
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f) The company is expanding and is adding a research department. They will be hiring a Horace, Horatio and Herbert to the department. Herbert will, naturally, be the boss of this department. Explain how the above code can be modified to include these changes and gives examples. [3 Marks]
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$\qquad$
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g) Describe the advantages of using the Logical Paradigm over the other paradigms we have studied in solving the problem described above. [3 Marks]
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$\qquad$
$\qquad$
$\qquad$
$\qquad$
$\qquad$

## End Of Examination

## 2013

## HIGHER SCHOOL CERTIFICATE

## TRIAL EXAMINATION

## Software Design \& Development

$30 \%$ Weighting

## General Instructions

- Reading time: 5 minutes
- Working time: 3 hours
- Write using black or blue pen ONLY
- Draw diagrams using pencil
- Write your Student Number on each page and booklet

Section I: Use separate answer sheet provided

Section II: Write all answers in this booklet

Section III: Write all answers in this booklet

NOTE: You will be supplied a booklet of spare paper for working out if required.

Total marks - 100

Section I [20 Marks]

- Attempt Questions 1-20
- Allow around 35 minutes for this section


## Section II [60 Marks]

- Attempt all the questions in this section
- Allow around 1 hour and 50 minutes for this section


## Section III [20 Marks]

- Attempt all the questions in this section
- Allow around 35 minutes for this section


## Section I: Multiple Choice

All questions are worth 1 Mark.

1. The value 12.0 would best be stored in:
a. An integer
b. A float
c. A string
d. An array

Consider the following piece of code:

$$
\begin{aligned}
& a=[2,0,3,4,1] \\
& x=a[a[a[3)]] \\
& \text { PRINT } x
\end{aligned}
$$

2. What will the output be of the algorithm above?
a. 0
b. 1
c. 2
d. 3

Consider the following EBNF statement:

```
<zug> = 1|2|3|4
<zag> = a|b|c|d
<zig> = <zag>{<zug>}
<zeg> = <zig> | <zag> [<zug><zug>]
```

3. Which of the following statements are legal for <zeg>?
a. a323d1
b. d2215a
c. $\mathbf{a 1 3 1 3 4}$
d. 44 a 22
4. Convert 111 to a binary number:
a. 01000011
b. 01101111
c. 7
d. 17

Consider the following algorithm:

```
# my sort
my_list = [12, 5, 13, 8, 9, 65]
sort_algorithm[u_list]
    length = len[u_list] - 1
    sorted = False
    while not sorted:
    sorted = True
    for i in range(length):
        if u_list[i] > u_list [i+1]:
            sorted = False
            u_list [i], u_list [i+1] = u_list [i+1], u_list [i]
        end if
    next
    end while
sort_algorithm(my_list)
print my_list
```

5. The above code is an example of:
a. Binary Search
b. Bubble Sort
c. Insertion Sort
d. Selection Sort
6. A diagram is designed to specifically show the data that goes into a system, how it is processed and the data exiting a system is called a:
a. Flow chart
b. Structure Diagram
c. Storyboard
d. IPO Chart

Consider the following algorithm for question 7:

```
a = 3
b = 4
c=1
while c > a:
            if b > a:
            c=c-1
            b=b-a
            a = b - 2
    end if
end while
print c
```

7. What is the final output and how many times does the algorithm loop through the while statement?
a. Output 1, Iterations 0
b. Output 0, Iterations 1
c. Output-1, Iterations 2
d. Output 4, Iterations 5

Consider the following algorithm:

```
some_var = arrNum[0]
for i = 0 to upper[arrNum] //iterate through each item
    if arrNum[i] > some_var then
        some_var = arrNum[i]
    end if
next i
```

8. The above algorithm above will:
a. Find the maximum value in an array
b. Find the minimum value in an array
c. Swap two value around
d. Cause an error
9. A Gantt chart is used to help project managers:
a. Break up tasks into manageable sections
b. Schedule the priorities of tasks
c. Show resources being used in tasks
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Consider the following flowchart:

10. When tested with the following data $[17,30,54,45,23,50]$, what will Total be at the end of the process?
a. 30
b. 75
c. 125
d. 219
11. Testing the inputs and outputs only of a system is an example of:
a. White box testing
b. System wide testing
c. Black box testing
d. Sub-Process testing
12. A token dictionary is used during compilation to:
a. Store the data in variables
b. Show the compiler which sections of the code to ignore (like whitespace)
c. Store the language elements of the program
d. Store the instructions passed to the compiler

Consider the following code snippet:

```
MOV X,DO
MOV N,D1
MOV D0,D2
SUB #1,D1
```

13. The above example of code is most likely an example of which generation of programming languages?
a. First generation
b. Second generation
c. Third generation
d. Fourth generation

Consider the following algorithm:

```
DO
    PRINT x
    x = x-1
UNTIL x <= 10
```

14. The above algorithm above is an example of a:
a. Nested loop
b. Unguarded loop
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15. Whilst a program is executing, where is the next instruction being stored?
a. Secondary storage
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16. Someone who is playing cards and sorts their hand by choosing the next card in a set and moving it to the right position is most likely using:
a. A Bubble Sort
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c. A Selection Sort
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Consider the following diagram:

17. Which implementation methodology is the above diagram illustrating?
a. Direct Cut Over
b. Phased
c. Parallel
d. Pilot
18. CASE Tools are:
a. Used in the planning stages of a project only
b. Used in the design stage of a project only
c. Used in the defining, planning and testing stages of a project
d. Used throughout all stages of a project

Consider the following Railroad Diagram:

19. In the above diagram, which of the following is a legal value for floom?
a. 11a
b. 45 bb
c. $7+7 \mathrm{a} 9 \mathrm{c}$
d. $56+92$
20. An application that can be used on different operating systems is considered to be:
a. Backward compatible
b. Forward compatible
c. Portable
d. Operationally reliable

## Section II

## Question 21

A retail company is planning to purchase large amounts of credit card transaction histories from a bank. They are planning to use this information to customize a website based on who you are and your past purchases. The service is opt-in and will allow the user to see a highly focused set of shopping recommendations based on their profile. The intention is that it will make it easier for users to find something that they are interested in.
a) With regard to the scenario described above, analyse three social and ethical issues that will need to be taken into consideration when planning and building the service. [6 Marks]

| Selects and analyses three social and ethical issues with appropriate amount of <br> detail for each | 6 |
| :--- | :--- |
| List and describes three social and ethical issues that are relevant to the scenario | $4-5$ |
| Describes two social and ethical issues that are only loosely applicable to the <br> scenario | $2-3$ |
| Lists two issues or describes one issue | 1 |

b) Discuss TWO rights and responsibilities of the developer when creating any piece of software.
[4 Marks]

| Selects and discusses two rights and responsibilities of the developer that are <br> relevant to any development. | $3-4$ |
| :--- | :--- |
| Selects and discusses one right or responsibility | 2 |
| Identifies or outlines one right or responsibility | 1 |

## Question 22

A Science Fiction magazine is planning to move online only distribution. With this move, they wish to try some innovative new features. For example, they would like to create a customizable issue of the magazine as a PDF based on stories that the reader likes and might be interested in.

They will be moving all of their current subscribers to the online model with their current magazine stories already credited to their account.

New subscribers will get a number of credits per month to spend on stories that will be added to their account. As they purchase more stories and mark them as read and rate them an algorithm will start to compile a profile on their reading habits. This will be used to direct editors in selecting content, and also used in promotions targeting their readers.

Users will be able to spend their credits purchasing stories to add to their magazine, or they can allow the algorithm to create it for them based on their profile. If the algorithm completes the magazine for the user, the cost in credits will be halved.
a) Construct a 1 st Level Data Flow Diagram of the above scenario.
[4 Marks]

| Properly formatted DFD which uses the processes, entities and data lines <br> described above | 4 |
| :--- | :--- |
| DFD which uses the processes, entities and data lines described above with some <br> formatting issues | $2-3$ |
| An appropriate attempt at a DFD | 1 |

b) Construct a System Flowchart for the creation of the monthly magazine and charging of credits to the user.

| Properly formatted diagram which uses the modules and data described above | 4 |
| :--- | :--- |
| A diagram which uses the modules and data described above with some <br> formatting issues | $2-3$ |
| An appropriate attempt at a diagram | 1 |

As the new Science Fiction magazine continues to grow, they will want to add new features to the system, like levels of membership, the ability to add your own stories to their collection and a way to print a hardbound collection of the magazine at the end of the year.
c) Compare and contrast TWO development methodologies that could be used for the above business and recommend one.
[4 Marks]

| Compares and contrasts two development methodologies in context of the <br> scenario | $3-4$ |
| :--- | :--- |
| Selects and discusses two development methodologies without applying it to the <br> case study | 2 |
| Outlines a development methodology | 1 |

## Question 23

Battleship is a game played across a grid of 10 by 10 squares. Each player places a number of ships across these squares of various sizes. Each player takes turns in calling out squares to the other player. If they call a square that contains a ship, they score a hit. The player who 'sinks' the opponent's ships first is the winner.

You have been tasked with creating an online version of the game of Battleship. During development an array is used to store all of the placed ships ( 9 in total). For the sake of easy testing in the early stages of development, all the ships are placed lengthwise like this:

$$
\begin{gathered}
0123456789 \\
0 \sim \sim \sim \sim \sim \sim \sim \sim \sim \\
1 \sim \sim \sim \sim \sim \sim \sim \sim \\
2 \sim \# \# \# \sim \sim \sim \sim \sim \sim
\end{gathered}
$$

A two-dimensional array sea_array stores each wave (" $\sim$ ") or part of a ship ("\#").
a) Compose an algorithm that will detect whether a ship is in a square or not. The input will be a number 0 to 9 twice as x and y .

If it is a hit, the output will need to be:

Coordinates X, Y: A hit!

Otherwise:

## Coordinates X, Y: A miss!

| Creates an algorithm that is in proper pseudocode or flowchart form that returns <br> the correct input | 4 |
| :--- | :--- |
| Creates an algorithm that returns the correct output but with some issues with <br> form | 3 |
| Makes an attempt at the algorithm | $1-2$ |

As development on the Battleship game continues, a sub-routine needs to be created to show where all of the ships are for a player and display which ships have been hit and where.

An array named ship_hit is used to store the hits to ships as they occur. Hits on ships are displayed with an asterix ("*"). For example:

```
~~#**##~~~
```

b) Construct an algorithm that will print a screen of all the ships and the hits that they have in a 10 by 10 grid. If you make any assumptions about other sub-routines or code, include them in the comments.
[5 Marks]

| Creates an algorithm that is in proper pseudocode or flowchart form that returns <br> the correct input | $4-5$ |
| :--- | :--- |
| Creates an algorithm that returns the correct output but with some issues with <br> form | 3 |
| Makes an attempt at the algorithm | $1-2$ |

## Question 24

A local cupcake store has proven to be very successful and is planning to grow their business. They would like to add online orders for special events to their offerings. Currently, they offer 12 varieties of cupcakes and they can do 3 different styles of icing. They can also do gluten-free cupcakes if required. For special occasions they will also allow you to do a custom message on one of the cupcakes that is 20 characters long. They also feel that it is important that a photo of each kind of cupcake is viewable when ordering.

Orders will be limited to only 3 kinds of cupcakes and delivery can be added if required.
a) Complete a screen design for the main order page that would be appropriate for the ordering process.
[4 Marks]

| Creates a screen design that is applicable to the scenario described, includes all <br> listed elements, uses proper controls and is properly labeled | $3-4$ |
| :--- | :--- |
| Creates a screen design that is loosely applicable to the scenario or makes an <br> effort to properly label a diagram | 2 |
| Makes an appropriate attempt at the question | 1 |

The twelve types of cupcakes fall into three price categories, Simple at $\$ 2$ each, Fancy at $\$ 3$ each and Super Awesome at $\$ 5$ each. The custom message will cost a further $\$ 12$. To do gluten-free cupcakes will cost an additional $\$ 1.20$ per cupcake ordered. Delivery is $\$ 25$ if required.
b) Construct an algorithm that will calculate the cost of an order.
[5 Marks]

| Creates an algorithm that is in proper pseudocode or flowchart form that returns <br> the correct input | $4-5$ |
| :--- | :--- |
| Creates an algorithm that returns the correct output but with some issues with <br> form | 3 |
| Makes an attempt at the algorithm | $1-2$ |

## Question 25

Steve works in the Accounting department. His boss has asked him to consider ways that they can improve their filing of invoices. The current system includes many different paper forms that need to be passed around the various departments and heads for sign off. The boss feels that this could be much improved.

The proposal is to create a system where each form is filled out online. Once it has been completed, an alert is sent to the relevant heads of departments to approve or disapprove the invoice. The names of those who need to sign off on each form or invoice are stored in a database and the form type number will indicate who is responsible. Once all e-signatures have been collected, the form will be sent to Steve for processing.
a) Construct a Structure Diagram illustrating the system described above.
[4 Marks]

| Properly formatted diagram which uses the modules and data described above | 4 |
| :--- | :--- |
| A diagram which uses the modules and data described above with some <br> formatting issues | $2-3$ |
| An appropriate attempt at a diagram | 1 |

b) As the system is being built, the issue of how the system will be implemented needs to be decided upon. Outline THREE considerations when deciding on an implementation methodology.
[3 Marks]

| For each appropriate implementation consideration | 1 Mark |
| :--- | :--- |

c) In the planning stages of the solution the IT Department wishes to make sure that they have fully understood the system as it currently works in its non-digital form. Discuss THREE methods that could be used by their Systems Analyst to make sure that they have a full understanding of current methodologies used by the company. [3 Marks]

| For each appropriate method discussed | 1 Mark |
| :--- | :--- |

## Question 26

a) List the steps in the FETCH EXECUTE cycle in order.

| For each two steps | 1 Mark |
| :--- | :--- |
| In order | 1 Mark |

b) List and describe the stages of the Structured Development Methodology.

| Lists and describes the stages in order | 5 |
| :--- | :--- |
| Lists and partially describes the stages | 4 |
| Outlines the steps out of order | $2-3$ |
| Appropriate attempt at the question | 1 |

c) Construct a Parse Tree for the following assignment:

$$
x=9+3 * y
$$

| Properly constructed parse tree that demonstrates an understanding of the <br> assignment operation listed above | 2 |
| :--- | :--- |
| Appropriate attempt at a parse tree | 1 |

## Section III: Option Topic

## Question 27

Consider the following Object Oriented code for describing employees in a.

```
Class Employee extends Person {
    Public {
        Int payrollID;
        Int deptID;
        String Name;
        String Title;
        date dob;
        double salary;
    }
    Private {
        Void pay[];
        Void changeDept[];
        Void changeTitle[];
    }
}
```

The above code is to be extended to include the attributes hireDate, reportTo and yearlyBonus. The methods changeBoss(), changeHireDate() and payBonus() also need to be added.
a) Compose a child class that extends from the parent Employee class to include the listed properties and methods.

| Correctly creates a child class that inherits from the parent class using the syntax <br> as given in the scenario | 3 |
| :--- | :--- |
| Attempts to create a child class | $1-2$ |

b) Discuss two ways in which a Programming Paradigm can affect the programmer's productivity when completing a project. [4 Marks]

| Identifies and discusses two ways in which the paradigm selected affects the <br> programmer | $3-4$ |
| :--- | :--- |
| Outlines 2 methods | 2 |
| Outlines 1 method | 1 |

c) Compare and contrast how using Inheritance in Object Oriented Programming benefits the developer as opposed to using the Logic paradigm.
[3 Marks]

| Compares and contrasts the two paradigms | 3 |
| :--- | :--- |
| Outlines some features of each | 2 |
| Outlines a feature | 1 |

d) Describe the process of encapsulation and how it can be used to a programmer's advantage when working on large projects with many other developers.
[2 Marks]

| Correctly identifies and describes how encapsulation is used in large development <br> environments | 2 |
| :--- | :--- |
| Describes encapsulation | 1 |

Consider the following Prolog code used to identify who works in which department and for whom:

```
employee[steve].
employee[jill].
employee[jake].
employee[paul].
employee[duncan].
employee[michelle].
employee[dwayne].
employee[lisette].
dept[accounting, steve].
dept[accounting, jill].
dept[accounting, jake].
dept[retail, paul].
dept[retail, duncan].
dept[retail, michelle].
dept[marketing, dwayne].
dept[marketing, lisette].
boss[duncan).
boss[dwayne].
boss[steve].
worksWith[X,Y]:- dept[Z,X], dept[Z,Y].
```

e) Compose a rule that will identify if an employee is the boss of a department. [2 Marks]

| Correctly writes the rule using appropriate syntax | 2 |
| :--- | :--- |
| Makes an appropriate attempt at the question | 1 |

f) The company is expanding and is adding a research department. They will be hiring a Horace, Horatio and Herbert to the department. Herbert will, naturally, be the boss of this department. Explain how the above code can be modified to include these changes and gives examples. [3 Marks]

| Correctly adds the rules as required in the appropriate syntax | 3 |
| :--- | :--- |
| Makes an appropriate attempt at the rule | $1-2$ |

g) Describe the advantages of using the Logical Paradigm over the other paradigms we have studied in solving the problem described above. [3 Marks]

| Correctly identifies the advantages of the logic paradigm and trouble other <br> paradigms would have with the scenario | 3 |
| :--- | :--- |
| Makes an attempt to justify logic over another paradigm | $1-2$ |

