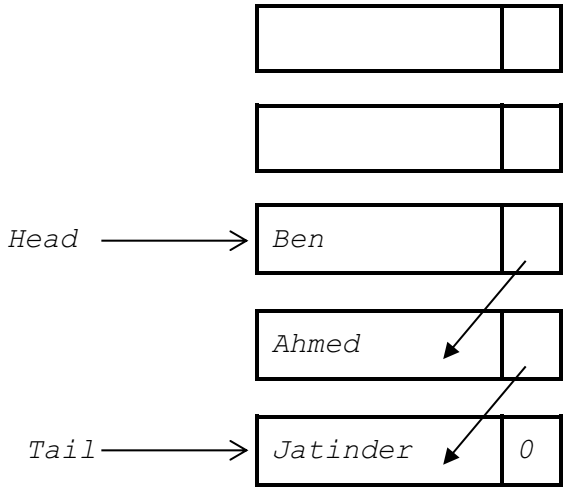
QUESTION 4.

6 (a)



1 mark for Head and Tail pointers
1 mark for 3 correct items – linked as shown
1 mark for correct order with null pointer in last nod **[3]**

(b) (i)

Queue

HeadPointer		Name	Po
0	[1]		
	[2]		
TailPointer	[3]		
0	[4]		5
	[5]		6
FreePointer	[6]		7
1	[7]		8
	[8]		9
	[9]		10
	[10]		0

Mark as follows:

HeadPointer =0 & TailPointer = 0
FreePointer assigned a value
Pointers[1] to [9] links the nodes together
Pointer[10] = 'Null' **[4]**

(ii)

```
PROCEDURE RemoveName()
    // Report error if Queue is empty
    IF HeadPointer = 0
        THEN
            Error
        ELSE
            OUTPUT Queue[HeadPointer].Name
            // current node is head of queue
            CurrentPointer ← HeadPointer
            // update head pointer
            HeadPointer ← Queue[CurrentPointer].Pointer
            //if only one element in queue,then update tail pointer
            IF HeadPointer = 0
                THEN
                    TailPointer ← 0
            ENDIF
            // link released node to free list
            Queue[CurrentPointer].Pointer ← FreePointer
            FreePointer ← CurrentPointer
    ENDIF
ENDPROCEDURE
```

[max 6]

QUESTION 5.

6 **(a)** A procedure that calls itself // is defined in terms of itself **[1]**

(b) Before procedure call is executed current state of the registers/local variables is saved onto the stack
When returning from a procedure call the registers/local variables are re-instated **[2]**

(c)

Call number	n	(n=0) OR (n=1)	n DIV 2	n MOD 2
1	40	FALSE	20	0
2	20	FALSE	10	0
3	10	FALSE	5	0
4	5	FALSE	2	1
5	2	FALSE	1	0
6	1	TRUE		
		1 mark	*1 mark*	*1 mark*

OUTPUT 101000 – 1 mark for each pair of bits. **[6]**

(d) Conversion of denary number into binary **[1]**

(e) (i) Example Pascal

```
Procedure X(n: INTEGER)
BEGIN
  IF (n = 0) OR (n = 1)
    THEN
        Write(n)
    ELSE
      BEGIN
        X(n DIV 2);
        Write(n MOD 2);
      END;
END;
```

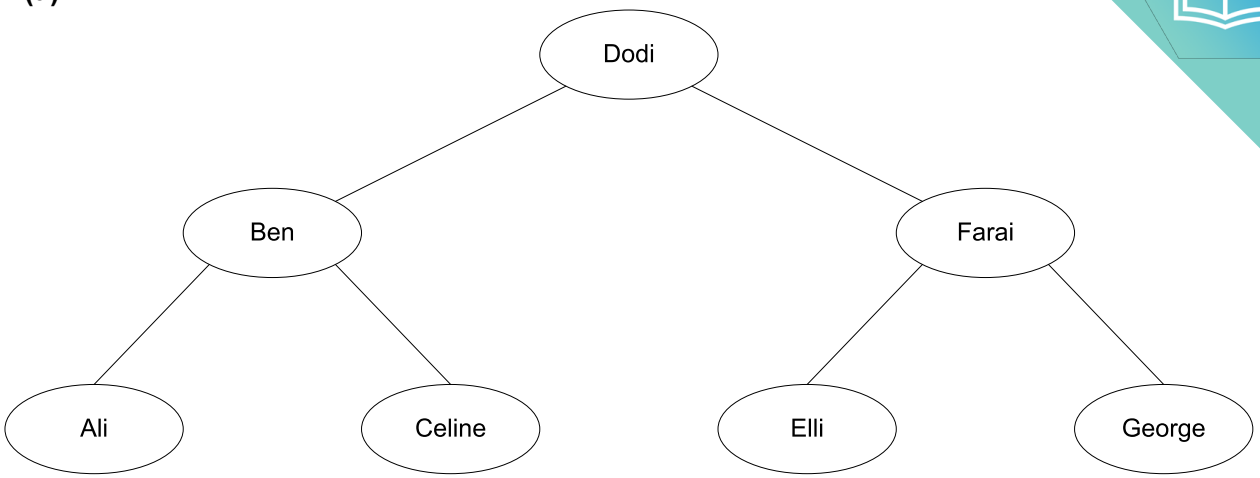
Example Python

```
def X(n):
    if (n == 0) or (n == 1):
       print(n, end="")
    else:
       X(n // 2)
       print(n % 2, end="")
```

Mark as follows:
Procedure heading & ending
Boolean expression
correctly grouped statements within ELSE
recursive call
Using DIV and MOD correctly **[5]**

QUESTION 6.

4 (a)



[4]

(b)

RootPointer: 1

FreePointer: 8

Tree

	Name	LeftPointer	RightPointer
[1]	Dodi	5	2
[2]	Farai	3	4
[3]	Elli	0	0
[4]	George	0	0
[5]	Ben	7	6
[6]	Celine	0	0
[7]	Ali	0	0
[8]		9	0
[9]		10	0
[10]		0	0

[7]

(c) (i)

```
01 PROCEDURE TraverseTree(BYVALUE Root : INTEGER)
02     IF Tree[Root].LeftPointer < > 0
03         THEN
04             TraverseTree(Tree[Root].LeftPointer)
05     ENDIF
06     OUTPUT Tree[Root].Name
07     IF Tree[Root].RightPointer < > 0
08         THEN
09             TraverseTree(Tree[Root].RightPointer)
10     ENDIF
11 ENDPROCEDURE
```

[5]

(ii) A procedure that calls itself // is defined in terms of itself
Line number: 04/09

[2]

QUESTION 7.

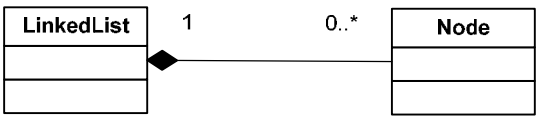
1 (a) (i)	`TYPE LinkedList` 1
	
	`(DECLARE) Surname : STRING` 1
	`(DECLARE) Ptr : INTEGER`
	
	`ENDTYPE` 1
	
	Accept:
	`LinkedList : RECORD` 1
	
	`Surname : STRING` 1
	`Ptr : INTEGER`
	
	`ENDRECORD` 1
	
	Accept:
	`TYPE LinkedList = RECORD` 1
	
	`Surname : STRING` 1
	`Ptr : INTEGER`
	
	`ENDTYPE / ENDRECORD` 1
	
	Accept:
	`STRUCTURE LinkedList` 1
	
	`(DECLARE) Surname : STRING` 1
	`(DECLARE) Ptr : INTEGER`
	
	`ENDSTRUCTURE` 1
	
	Accept `AS / OF` instead of `:`	

(ii)	`(DECLARE)` **`SurnameList[1:5000]`** `:` **`LinkedList`** Accept `AS / OF` instead of `:` Accept `()` instead of `[]` Accept without lower bound Index separator can be `,` `:` `...`	**2**
(b) (i)	`Wu` Accept with quotes	**1**
(ii)	`6`	**1**
(c) (i)	`IsFound` + relevant description 1 `BOOLEAN` 1	**2**

Question	Answer

(ii)	Accept `()` instead of `[]`
	`01 Current ← StartPtr`
	`02 IF Current = 0`
	`03 THEN`
	`04 OUTPUT "Empty List"` (or similar message) (accept without quotes) Reject "Error"
	`05 ELSE`
	`06 IsFound ← FALSE`
	`07 INPUT ThisSurname`
	`08 REPEAT`
	`09 IF SurnameList[Current].Surname = ThisSurname`
	`10 THEN`
	`11 IsFound ← TRUE`
	`12 OUTPUT "Surname found at position ", Current`
	`13 ELSE`
	`14 // move to the next list item`
	`15 Current ← SurnameList[Current].Ptr`
	`16 ENDIF`
	`17 UNTIL IsFound = TRUE OR Current = 0`
	`18 IF IsFound = FALSE`
	`19 THEN`
	`20 OUTPUT "Not Found"`
	`21 ENDIF`
	`22 ENDIF`

QUESTION 8.

Question	Answer	Marks
4(a)(i)	containment/aggregation	**1**
4(a)(ii)	 1 mark for the two classes (in boxes) and connection with correct end point 1 mark for 0 ..* 0	**Max 2**

Question	Answer	

4(b)	**mark as follows:**
	• Class heading and ending
	• Constructor heading and ending
	• Parameters in constructor heading
	• Declaration of (private) attributes : Pointer, Data
	• Assignment of parameters to Pointer and Data
	
	Python Example
	`class Node:` 1
	`def __init__(self, D, P):` 1 + 1
	`self.__Data = D` 1
	`self.__Pointer = P` 1
	`return`
	
	Example Pascal
	`type` } `Node = class` 1
	`private` 1
	`Data : String;` } `Pointer : Integer;`
	`public`
	`constructor Create(D : string; P : integer);`
	`procedure SetPointer(P : Integer);`
	`procedure SetData(D : String);`
	`function GetData() : String;` } ignore
	`function GetPointer() : Integer;`
	`end;`
	`constructor Node.Create(D : string; P : integer);` 1+1
	`begin`
	`Data := D;` } `Pointer := P;` 1
	`end;`
	
	Example VB.NET
	`Class Node` 1
	`Private Data As String` } `Private Pointer As Integer` 1
	`Public Sub New(ByVal D As String, ByVal P As Integer)` 1+1
	`Data = D` } `Pointer = P` 1
	`End Sub`
	`End Class`	

4(c)(i)	A pointer that doesn't point to any data/node/address	**1**

Question	Answer	
4(c)(ii)	–1 (accept NULL) The array only goes from 0 to 7 // the value is not an array index	
4(c)(iii)	**mark as follows:** • Class and constructor heading and ending • Declare private attributes (HeadPointer, FreeListPointer, NodeArray) • Initialise HeadPointer to null • Initialise FreeListPointer to 0 • Looping 8 times … • Creating empty node in NodeArray • Use .SetPointer method to point each new node to next node • Set last node pointer to null pointer	**Max 7**

Python Example

```
class LinkedList:                                          1
   def __init__(self):                                    1
      self.__HeadPointer = - 1                             1
      self.__FreeListPointer = 0                           1
      self.__NodeArray = []
      for i in range(8):                                   1
         ThisNode = Node("", (i + 1))                      1
         self.__NodeArray.append(ThisNode)
      self.__NodeArray[7].SetPointer(- 1)                  1
```

Example Pascal

```
type
LinkedList = class                                         1
      private
         HeadPointer : Integer;
         FreeList : Integer;
         NodeArray : Array[0..7] of Node;
      public
         constructor Create();
         procedure FindInsertionPoint(NewData : string; var
                     PreviousPointer, NextPointer : integer);
         procedure AddToList(NewData : string);
         procedure OutputListToConsole();
   end;
constructor LinkedList.Create();                           1
   var i : integer;
   begin
      HeadPointer := -1;                                   1
      FreeList := 0;                                       1
      for i := 0 To 7 do                                   1
         NodeArray[i] := Node.Create('', (i + 1));         1
      NodeArray[7].SetPointer(-1);                         1
   end;
```

Question	Answer	

	Example VB.NET
	`Class LinkedList` 1
	`  Private HeadPointer As Integer`
	`  Private FreeList As Integer`
	`  Private NodeArray(7) As Node`
	
	`  Public Sub New()` 1
	`  HeadPointer = -1` 1
	`  FreeList = 0` 1
	`  For i = 0 To 7` 1
	`  NodeArray(i) = New Node("", (i + 1))` 1
	`  Next`
	`  NodeArray(7).SetPointer(-1)` 1
	`  End Sub`
	`End Class`	

4(c)(iv)	• Creating instance of LinkedList assigned to contacts
	
	Python Example
	`contacts = LinkedList()`
	
	Pascal Example
	`var contacts : LinkedList;`
	`  contacts := LinkedList.Create;`
	
	VB.NET Example
	`Dim contacts As New LinkedList`
		1

Question	Answer	

4(c)(v)	**mark as follows:**
	• Start with HeadPointer
	• Output node data
	• Loop until null pointer
	• Following pointer to next node
	• Use of getter (ie GetData/GetPointer)
	
	Python Example
	`def OutputListToConsole(self) :`
	`  Pointer = self.__HeadPointer` 1
	`  while Pointer != -1 :` 1
	`  print(self.__NodeArray[Pointer].GetData())` 1+1
	`  Pointer = self.__NodeArray[Pointer].GetPointer()` 1
	`  print()`
	`  return`
	
	Pascal Example
	`procedure LinkedList.OutputListToConsole();`
	`  var Pointer : integer;`
	`  begin`
	`  Pointer := HeadPointer;` 1
	`  while Pointer <> -1 do` 1
	`  begin`
	`  WriteLn(NodeArray[Pointer].GetData);` 1+1
	`  Pointer := NodeArray[Pointer].GetPointer;` 1
	`  end;`
	`  end;`
	
	VB.NET Example
	
	`Public Sub OutputListToConsole()`
	`  Dim Pointer As Integer`
	`  Pointer = HeadPointer` 1
	`  Do While Pointer <> -1` 1
	`  Console.WriteLine(NodeArray(Pointer).GetData)` 1+1
	`  Pointer = NodeArray(Pointer).GetPointer` 1
	`  Loop`
	`End Sub`	

Question	Answer	

4(c)(vi)	**mark as follows:**
	• Store free list pointer as NewNodePointer
	• Store new data item in free node
	• Adjust free pointer
	• F list is currently empty
	• Make the node the first node
	• Set pointer of this node to Null Pointer
	• Find insertion point
	• If previous pointer is Null pointer
	• Link this node to front of list
	• Link new node between Previous node and next node
	
	Python Example
	`def AddToList(self, NewData):`
	
	`  NewNodePointer = self.__FreeListPointer`
	
	`  self.__NodeArray[NewNodePointer].SetData(NewData)`
	
	`  self.__FreeListPointer = self.__NodeArray[self.__FreeListPointer].GetPointer()`
	
	`  if self.__HeadPointer == -1:`
	
	`  self.__HeadPointer = NewNodePointer`
	`  self.__NodeArray[NewNodePointer ].SetPointer(-1)`
	`  else:`
	`  PreviousPointer, NextPointer = self.FindInsertionPoint(NewData)`
	`  if PreviousPointer == -1 :`
	
	`  self.__NodeArray[NewNodePointer ].SetPointer (self.__HeadPointer)`
	`  self.__HeadPointer = NewNodePointer`
	`  else:`
	
	`  self.__NodeArray[NewNodePointer ].SetPointer(NextPointer)`
	`  self.__NodeArray[PreviousPointer].SetPointer(NewNodePointer)`	

Question	Answer

	Pascal Example
	`procedure LinkedList.AddToList(NewData : string);`
	`var NewNodePointer , PreviousPointer,`
	`NextPointer : integer;`
	`begin`
	`// make a copy of free list pointer`
	`NewNodePointer := FreeListPointer;`
	`// store new data item in free node`
	`NodeArray[NewNodePointer].SetData(NewData);`
	`// adjust free pointer`
	`FreeListPointer :=`
	`NodeArray[FreeListPointer].GetPointer;`
	`// if list is currently empty`
	`if HeadPointer = -1`
	`then`
	`// make the node the first node`
	`begin`
	`HeadPointer := NewNodePointer;`
	`// set pointer to Null pointer`
	`NodeArray[NewNodePointer].SetPointer(-1);`
	`end`
	`else`
	`// find insertion point`
	`begin`
	`FindInsertionPoint(NewData, PreviousPointer,`
	`NextPointer);`
	`// if previous pointer is Null pointer`
	`if PreviousPointer = -1`
	`then`
	`// link node to front of list`
	`begin`
	`NodeArray[NewNodePointer]`
	`.SetPointer(HeadPointer);`
	`HeadPointer := NewNodePointer ;`
	`end`
	`else`
	`// link new node between`
	`Previous node and next node`
	`begin`
	`NodeArray[NewNodePointer ]`
	`.SetPointer(NextPointer);`
	`NodeArray[PreviousPointer]`
	`.SetPointer(NewNodePointer);`
	`end;`
	`end;`
	`end;`

Question	Answer

	VB.NET Example
	`Public Sub AddToList(ByVal NewData As String)`
	`  Dim NewNodePointer, PreviousPointer, NextPointer As Integer`
	`  ' make copy of free list pointer`
	`  NewNodePointer= FreeListPointer`
	`  ' store new data item in free node`
	`  NodeArray(NewNodePointer).SetData(NewData)`
	`  ' adjust free pointer`
	`  FreeListPointer = NodeArray(FreeListPointer).GetPointer`
	`  ' if list iscurrently empty`
	`  If HeadPointer = -1 Then`
	`  ' make the node the first node`
	`  HeadPointer = NewNodePointer`
	`  ' set pointer to Null pointer`
	`  NodeArray(NewNodePointer).SetPointer(-1)`
	`  Else`
	`  ' find insertion point`
	`  FindInsertionPoint(NewData, PreviousPointer,`
	`NextPointer)`
	`  ' if previous pointer is Null pointer`
	`  If PreviousPointer = -1 Then`
	`  ' link to front of list`
	`  NodeArray(NewNodePointer).SetPointer(HeadPointer)`
	`  HeadPointer = NewNodePointer`
	`  Else`
	`  ' link new node between Previous node and next node`
	`  NodeArray(NewNodePointer).SetPointer(NextPointer)`
	`  NodeArray(PreviousPointer).SetPointer(NewNodePointer)`
	`  End If`
	`  End If`
	`End Sub`

Question	Answer

Pseudocode for reference:

```
PROCEDURE AddToList(NewData)
   // remember value of free list pointer
   NewNodePointer ← FreeListPointer
   // add new data item to free node pointed to by free list
   NodeArray[NewNodePointer].Data ← NewData
   // adjust free pointer to point to next free node
   FreeListPointer  ← NodeArray[FreeList].Pointer
   // is list currently empty?
   IF HeadPointer = NullPointer
      THEN
         // make the node the first node
         HeadPointer ← NewnodePointer
         // set pointer of new node to Null pointer
         NodeArray[NewNodePointer].Pointer ← NullPointer
      ELSE
         // find insertion point
         CALL FindInsertionPoint(NewData, PreviousPPointer, NextPointer)
         // if previous pointer is Null pointer
         IF PreviousPointer = NullPointer
            THEN
               // link new node to front of list
               NodeArray[NewNodePointer].Pointer ← HeadPointer
               HeadPointer ← NewNodePointer
         ELSE
            // link new node between previous node and next node
            NodeArray[NewNodePointer].Pointer ← NextPOinter
            NodeArray[PreviousPointer].Pointer ← NewNodePointer
         END IF
   ENDIF
END PROCEDURE
```

QUESTION 9.

Question	Answer	Marks
2(a)	• A pointer that doesn't point to another node/other data/address // indicates the end of the branch	1
2(b)	one mark per bullet • node with 'Athens' linked to left pointer of Berlin (ignore null pointer) • null pointers in left and right pointers of Athens	2
2(c)(i)	RootPointer: 0 FreePointer: 7 **1 mark**	5

	LeftPointer	Tree Data	RightPointer
[0]	**2**	Dublin	**1**
[1]	**-1/∅**	London	**3**
[2]	**6**	Berlin	**5**
[3]	**4**	Paris	**-1/∅**
[4]	**-1/∅**	Madrid	**-1/∅**
[5]	**-1/∅**	Copenhagen	**-1/∅**
[6]	**-1/∅**	Athens	**-1/∅**
[7]	**8**		**-1/∅**
[8]	**9**		**-1/∅**
[9]	**-1/∅**		**-1/∅**

2(c)(ii)	• –1 • It is not the number for any node.	2

Question	Answer	Marks
2(d)(i)	TYPE Node **LeftPointer : INTEGER** **RightPointer : INTEGER** 1 **Data : STRING** ENDTYPE DECLARE Tree : ARRAY[0 : 9] **OF Node** 1 DECLARE FreePointer : INTEGER DECLARE RootPointer : INTEGER PROCEDURE CreateTree() DECLARE Index : INTEGER **RootPointer ← -1** 1 **FreePointer ← 0** 1 FOR Index ← 0 TO 9 // link nodes **Tree[Index].LeftPointer ← Index + 1** 1 **Tree[Index].RightPointer ← -1** 1 ENDFOR **Tree[9].LeftPointer ← -1** 1 ENDPROCEDURE	**7**

Question	Answer	Marks

2(d)(ii)	PROCEDURE AddToTree(ByVal NewDataItem : STRING)
	// if no free node report an error
	IF FreePointer **= -1** 1
	THEN
	ERROR("No free space left")
	ELSE // add new data item to first node in the free list
	NewNodePointer ← FreePointer
	Tree[NewNodePointer].Data ← NewDataItem 1
	// adjust free pointer
	FreePointer ← **Tree[FreePointer].LeftPointer** 1
	// clear left pointer
	Tree[NewNodePointer].LeftPointer ← **-1** 1
	// is tree currently empty ?
	IF **RootPointer = -1** 1
	THEN // make new node the root node
	RootPointer ← NewNodePointer 1
	ELSE // find position where new node is to be added
	Index ← RootPointer
	CALL FindInsertionPoint(NewDataItem, Index, Direction)
		8

Question	Answer	Marks
	IF Direction = "Left" THEN // add new node on left **Tree[Index].LeftPointer ← NewNodePointer** 1 ELSE // add new node on right **Tree[Index].RightPointer ← NewNodePointer** **1** ENDIF ENDIF ENDIF ENDPROCEDURE	
2(e)	**1 mark per bullet** • test for base case (null/-1) • recursive call for left pointer • output data • recursive call for right pointer • order, visit left, output, visit right IF Pointer <> NULL 1 THEN TraverseTree(Tree[Pointer].LeftPointer) 1 OUTPUT Tree[Pointer].Data 1 + 1 TraverseTree(Tree[Pointer].RightPointer) 1 ENDIF ENDPROCEDURE	**5**

QUESTION 10.

Question	Answer	Marks

4(a)	1 mark per item in bold
	
	`FOR Pointer ← 1 TO (Max – 1)`
	`  ItemToInsert ← Numbers[Pointer]`
	`  CurrentItem ← Pointer`
	`  WHILE (CurrentItem > 0) AND (Numbers[CurrentItem – 1] > ItemToInsert)`
	`  Numbers[CurrentItem] ← Numbers[CurrentItem – 1]`
	`  CurrentItem ← CurrentItem – 1`
	`  ENDWHILE`
	`  Numbers[CurrentItem] ← ItemToInsert`
	`ENDFOR`
		4

4(b)	• The size of the array // value of Max • How ordered the items already are	**2**

QUESTION 11.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>• LIFO / last in first out</td><td>1</td></tr>
<tr><td>3(b)(i)</td><td>Points to the next free space on the stack</td><td>1</td></tr>
<tr><td>3(b)(ii)</td><td>1 mark per bullet to max 3

• Correct stack contents
• StackPointer = 4

<table>
<tr><td>StackPointer</td><td>4</td><td>StackContents</td></tr>
<tr><td></td><td>0</td><td>"Screw 1"</td></tr>
<tr><td></td><td>1</td><td>"Screw 2"</td></tr>
<tr><td></td><td>2</td><td>"Back case"</td></tr>
<tr><td></td><td>3</td><td>"Light 1"</td></tr>
<tr><td></td><td>4</td><td></td></tr>
<tr><td></td><td>5</td><td></td></tr>
<tr><td></td><td>6</td><td></td></tr>
<tr><td></td><td>7</td><td></td></tr>
</table>
</td><td>2</td></tr>
</table>

Question	Answer	Marks

3(c)(i)	1 mark for each correct statement:
	
	`PROCEDURE POP`
	`  IF StackPointer = 0`
	`  THEN`
	`  OUTPUT ("The stack is empty")`
	`  ELSE`
	`  StackPointer ← StackPointer - 1`
	`  OUTPUT Parts[StackPointer]`
	`  Parts(StackPointer) ← "*"`
	`  ENDIF`
	`ENDPROCEDURE`
		5

3(c)(ii)	1 mark for each completed statement:
	
	`PROCEDURE PUSH (BYVALUE Value : String)`
	`  IF StackPointer > 19`
	`  THEN`
	`  OUTPUT "Stack full"`
	`  ELSE`
	`  Parts[StackPointer] ← Value`
	`  StackPointer ← StackPointer + 1`
	`  ENDIF`
	`ENDPROCEDURE`
		4

QUESTION 12.

Question	Answer	Marks
5(c)(ii)	1 mark per bullet point to max 2: Example: • If there is any delay to a task which is part of the critical path • … then the overall project will be delayed • Gives the earliest possible completion time • … this allows you to organise/allocate resources (efficiently) • Frequently recalculate the critical path … • … to see if there are any delays/new critical path has arisen • Can identify where there is slack in activities • … so they can start later without affecting the critical path	**2**

Question	Answer	Marks

6(a)(i)	1 mark per bullet point:
	
	• Declaring a record type // class etc.
	• Declaring Country as a string
	• Declaring Pointer as an integer
	
	Example:
	
	`TYPE ListElement`
	`  DECLARE Country : STRING`
	`  DECLARE Pointer : INTEGER`
	`ENDTYPE`
		3

Question	Answer	Marks
6(a)(ii)	1 mark per bullet point: • Declaring `CountryList` as an array with 15 elements • Of type `ListElement` Example: `DECLARE CountryList : ARRAY[1 : 15] OF ListElement`	**2**

6(b)	1 mark for each completed statement
	
	`PROCEDURE DeleteNode(NodeValue: STRING, ThisPointer: INTEGER, PreviousPointer: INTEGER)`
	` IF CountryList[ThisPointer].Value = NodeValue`
	`  THEN`
	`  CountryList[ThisPointer].Value ← ""`
	`  IF ListHead = ThisPointer`
	`  THEN`
	`  ListHead ← CountryList[ThisPointer].Pointer`
	`  ELSE`
	`  CountryList[PreviousPointer].Pointer ← CountryList[ThisPointer].Pointer`
	`  ENDIF`
	`  CountryList[LastNode].Pointer ← ThisPointer`
	`  LastNode ← ThisPointer`
	`  CountryList[ThisPointer].Pointer ← -1`
	`  ELSE`
	`  IF CountryList[ThisPointer].Pointer <> -1`
	`  THEN`
	`  CALL DeleteNode(NodeValue,CountryList[ThisPointer].Pointer, ThisPointer)`
	`  ELSE`
	`  OUTPUT "DOES NOT EXIST"`
	`  ENDIF`
	` ENDIF`
	`ENDPROCEDURE`
		5

QUESTION 13.

2(b)	1 mark for each completed section
	
	`FUNCTION FindElement(Item : INTEGER) RETURNS INTEGER`
	`  CurrentPointer ← RootPointer`
	`  WHILE CurrentPointer <> NullPointer`
	`  IF List[CurrentPointer].Data <> Item`
	`  THEN`
	`  CurrentPointer ← List[CurrentPointer].Pointer`
	`  ELSE`
	`  RETURN CurrentPointer`
	`  ENDIF`
	`  ENDWHILE`
	`  CurrentPointer ← NullPointer`
	`  RETURN CurrentPointer`
	`ENDFUNCTION`
		6

2(c)(i)	1 mark per bullet point to max 3 e.g. • A sequence of steps that change the state of the program • The steps are in the order they should be carried out • e.g. procedural programming/language • Groups code into self-contained blocks // split the program into modules • … which are subroutines // by example	**3**

Question	Answer	
2(c)(ii)	1 mark per bullet point to max 3 e.g. • Creates classes • …as a blueprint for an object // objects are instances of classes • …that have properties/attributes **and** methods • … that can be private to the class // properties can **only** be accessed by the class's methods // encapsulation • **Subclasses** can inherit from **superclasses** (child and parent) • A **subclass** can inherit the methods and properties from the **superclass** • A **subclass** can change the methods from the **superclass** // **subclass** can use polymorphism • Objects can interact with each other	

2(d)(i)	1 mark per bullet point
	
	• Method header and close (where appropriate)
	• …with `InputPlayerID` parameter
	• Initialise `Score` to 0
	• Initialise Category to `"Not Qualified"`
	• Initialise `PlayerID` to parameter
	
	PYTHON
	`def__init__(self, InputPlayerID):`
	`  self.__Score = 0`
	`  self.__Category = "Not Qualified"`
	`  self.__PlayerID = InputPlayerID`
	PASCAL
	`Constructor Player.Create(InputPlayerID);`
	`begin`
	`  Score := 0 ;`
	`  Category := 'Not Qualified' ;`
	`  PlayerID := InputPlayerID;`
	`end;`
	VB
	`Public Sub New (InputPlayerID)`
	`  Score = 0`
	`  Category = "Not Qualified"`
	`  PlayerID = InputPlayerID`
	`End Sub`
		5

Question	Answer

2(d)(ii)	1 mark per bullet point
	
	• 1 get Method header without parameter (returning correct data type if given)
	• …returning the property
	• A second working Get
	• A third working Get
	
	PYTHON
	`def GetScore():`
	`  return (Score)`
	`def GetCategory():`
	`  return (Category)`
	`def GetPlayerID():`
	`  return (PlayerID)`
	
	PASCAL
	`function GetScore():Integer;`
	`begin`
	`  GetScore:= Score;`
	`end;`
	`function GetCategory():String;`
	`begin`
	`  GetCategory:= Category;`
	`end;`
	`function GetPlayerID():String;`
	`begin`
	`  GetPlayerID:= PlayerID;`
	`end;`
	
	VB
	`Public Function GetScore() As Integer`
	`  Return Score`
	`End Function`
	`Public Function GetCategory() As String`
	`  Return Category`
	`End Function`
	`Public Function GetPlayerID() As String`
	`  Return PlayerID`
	`End Function`

Question	Answer	

2(d)(iii)	1 mark per bullet point
	
	• Set method header and close (where appropriate)
	• Input value
	• Looping until input value is correct length …
	• … storing **valid** input value in `PlayerID`
	
	PYTHON
	`def SetPlayerID(self)`
	`  PlayerID = input("Enter your player ID")`
	`  while len(PlayerID) > 15 and len(PlayerId) < 4`
	`  PlayerID = input("Must be <=15 AND >=4 characters long. Enter your player ID")`
	
	PASCAL
	`Procedure SetPlayerID ()`
	`  WriteLn ('Enter your player ID');`
	`  ReadLn(PlayerID);`
	`  while length(PlayerID) > 15 and length(PlayerID) < 4 do`
	`  begin`
	`  WriteLn('Must be <=15 AND >=4 characters long. Enter your player ID');`
	`  ReadLn(PlayerID);`
	`  end;`
	
	VB
	`Public Sub SetPlayerID()`
	`  Console.WriteLine ("Enter your player ID")`
	`  PlayerID = Console.ReadLine()`
	`  While Len(PlayerID) > 15 and Len(PlayerID) < 4`
	`  Console.WriteLine ("Must be <=15 AND >=4 characters long. Enter your player ID")`
	`  PlayerID = Console.ReadLine()`
	`  End While`
	`End Sub`	

Question	Answer

2(d)(iv)	1 mark per bullet point
	
	• Function header and close (where appropriate) **and** takes `ScoreInput` as parameter
	• Check if 0 <= `ScoreInput` <= 150
	• …if valid, set `Score` to parameter
	• …if not valid, output error
	• Returns TRUE if valid **and** returns FALSE if not valid
	
	PYTHON
	`def __SetScore(ScoreInput):`
	`  if ScoreInput >=0 and ScoreInput <=150:`
	`  IsValid = True`
	`  self__Score = ScoreInput`
	`  else:`
	`  print("Error")`
	`  IsValid = False`
	`Return(IsValid)`
	
	PASCAL
	`function Player.SetScore(ScoreInput: Integer) : Boolean;`
	`begin`
	`  If (ScoreInput >=0) AND (ScoreInput <=150) Then`
	`  IsValid := True;`
	`  result := ScoreInput;`
	`  Else`
	`  WriteLn('Error')`
	`  result := False;`
	`end;`
	
	VB
	`Public Function SetScore(ByVal ScoreInput As Integer) As Boolean`
	`  If (ScoreInput >=0) And (ScoreInput <=150) Then`
	`  Return True`
	`  Score = ScoreInput`
	`  Else`
	`  Console.Writeline("Error")`
	`  Return False`
	`  End If`
	`End Function`

Question	Answer

2(d)(v)	1 mark per bullet point
	
	• Procedure header and close (where appropriate)
	• Accessing Score attribute
	• Correct selection to assign each category
	• … storing in Category attribute
	
	PYTHON
	`def SetCategory()`
	`  if self.__Score >120:`
	`  self.__Category = "Advanced"`
	`  elif self.__Score >80:`
	`  self.__Category = "Intermediate"`
	`  elif self.__Score>=50:`
	`  self.__Category = "Beginner"`
	`  else:`
	`  self.__Category = "Not Qualified"`
	
	PASCAL
	`procedure player.SetCategory()`
	`begin`
	`  If Score >120 Then`
	`  Category := "Advanced";`
	`  Else If Score >80 Then`
	`  Category := "Intermediate";`
	`  Else If Score >= 50 Then`
	`  Category := "Beginner";`
	`  Else`
	`  Category := "Not Qualified";`
	`end;`
	
	VB
	`Public Sub SetCategory()`
	`  If Score >120 Then`
	`  Category = "Advanced"`
	`  ElseIf Score >80 Then`
	`  Category = "Intermediate"`
	`  ElseIf Score >=50 Then`
	`  Category = "Beginner"`
	`  Else`
	`  Category = "Not Qualified"`
	`  End If`
	`End Sub`

Question	Answer

2(d)(vi)	1 mark per bullet point
	
	• `CreatePlayer()` header and close (where appropriate)
	• Input of `score` and `PlayerID` with suitable prompts
	• Create instance of `Player` named `JoannePlayer` …
	• …with `PlayerID` as parameter
	• Call method `SetScore` for `JoannePlayer` with parameter `Score`
	• …storing return value
	• …outputting appropriate message for not valid
	• Call `SetCategory` for `JoannePlayer`
	• Output Category for `JoannePlayer` …
	• … using `GetCategory` for object Joanne
	
	PYTHON
	`def CreatePlayer():`
	`  InputPlayerID = input("Enter your chosen ID")`
	`  Score = int(input("Please enter the score"))`
	`  JoannePlayer = Player(InputPlayerID)`
	`  if JoannePlayer.SetScore(Score) == false:`
	`  print("Invalid score")`
	`  else:`
	`  JoannePlayer.SetCategory()`
	`  print(JoannePlayer.GetCategory)`
	
	PASCAL
	`procedure CreatePlayer();`
	`  var`
	`  playerID : String;`
	`  isValid : boolean;`
	`  JoannePlayer : Player;`
	`  score : integer;`
	`  begin`
	`  Writeln(Enter Player ID: ');`
	`  Readln(playerID);`
	`  Writeln('Enter score: ');`
	`  Readln(score);`
	`  JoannePlayer := Player.Create(PlayerID);`
	`  isValid := JoannePlayer.SetScore(Score);`
	`  if isValid = true:`
	`  JoannePlayer.SetCategory();`
	`  Writeln(JoannePlayer.GetCategory());`
	`  else:`
	`  Writeln("Invalid score")`
	`end;`

<table>
<tr><th>Question</th><th>Answer</th><th></th></tr>
<tr><td>2(d)(vi)</td><td>VB
<pre>
Sub CreatePlayer()
    Dim Score As Integer, InputPlayerID As String
    Console.WriteLine("Please enter your chosen ID")
    InputPlayerID = Console.ReadLine()
    Console.WriteLine("Please enter the score")
    Score = Console.ReadLine()

    Dim JoannePlayer As New Player(InputPlayerID)
    if JoannePlayer.SetScore(Score) = True then
        JoannePlayer.SetCategory()
        Console.WriteLine(JoannePlayer.GetCategory())
    else
        Console.Writeline("Invalid score")
    endif
End Sub
</pre></td><td></td></tr>
<tr><td>2(e)</td><td>1 mark per bullet point

• 3 correct Normal test data
• 3 correct Abnormal test data
• 3 correct Boundary test data

<table>
<tr><th>Category</th><th>Type of test data</th><th>Example test data</th></tr>
<tr><td rowspan="3">Beginner</td><td>Normal</td><td>e.g. 75</td></tr>
<tr><td>Abnormal</td><td>e.g. 85 / bob</td></tr>
<tr><td>Boundary</td><td>80, 50</td></tr>
<tr><td rowspan="3">Intermediate</td><td>Normal</td><td>e.g. 95</td></tr>
<tr><td>Abnormal</td><td>e.g. 70 / bob</td></tr>
<tr><td>Boundary</td><td>81, 120</td></tr>
<tr><td rowspan="3">Advanced</td><td>Normal</td><td>e.g. 125</td></tr>
<tr><td>Abnormal</td><td>e.g. 115 / bob</td></tr>
<tr><td>Boundary</td><td>121, 150</td></tr>
</table></td><td>3</td></tr>
<tr><td>2(f)(i)</td><td>Insertion sort</td><td>1</td></tr>
<tr><td>2(f)(ii)</td><td>One from:
• Bubble sort
• Merge sort</td><td>1</td></tr>
</table>

Question	Answer
2(f)(iii)	1 mark per shaded section

Item	NumberOfScores	InsertScore	Index	ArrayData				
				0	1	2	3	4
				99	125	121	109	115
1	5	125	0		(125)			
2		121	1			125		
			0		121			
3		109	2				125	
			1			121		
			0		109			
4		115	3					125
			2				121	
			1			115		

QUESTION 14.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)(i)</td><td>1 mark for error and correction

Error 1 – <code>IF List[LowerBound] = SearchValue</code>
Correction – <code>IF List[MidPoint] = SearchValue</code>

Error 2 – <code>UpperBound ← MidPoint + 1</code>
Correction – <code>LowerBound ← MidPoint + 1</code>

Error 3 – <code>IF LowerBound > MidPoint</code>
Correction - <code>IF LowerBound > UpperBound</code>

Error 4 – <code>IF ValueFound = FALSE</code>
Correction – <code>IF ValueFound = TRUE</code></td><td>4</td></tr>
<tr><td>4(a)(ii)</td><td>Linear search</td><td>1</td></tr>
<tr><td>4(b)(i)</td><td>1 mark per shaded section

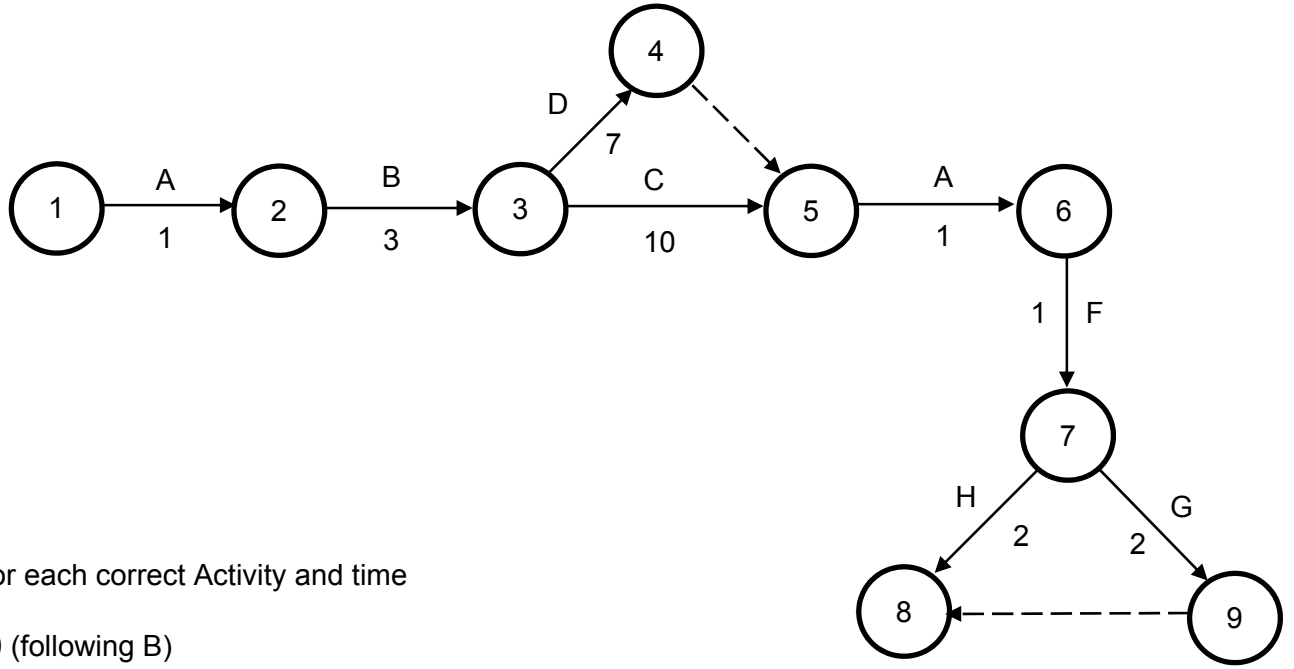
<table>
<tr><th rowspan="2">Count</th><th rowspan="2">TempValue</th><th rowspan="2">Sorted</th><th colspan="6">ArrayData</th></tr>
<tr><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>0</td><td>""</td><td>TRUE</td><td>5</td><td>20</td><td>12</td><td>25</td><td>32</td><td>29</td></tr>
<tr><td>1</td><td>12</td><td>FALSE</td><td></td><td>12</td><td>20</td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>29</td><td>(FALSE)</td><td></td><td></td><td></td><td></td><td>29</td><td>32</td></tr>
<tr><td>0</td><td></td><td>TRUE</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>4</td></tr>
</table>

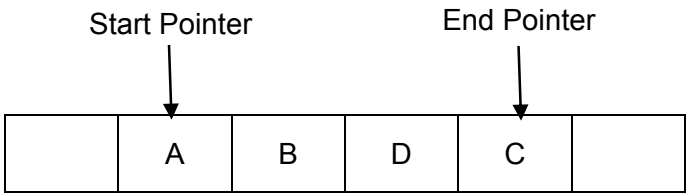
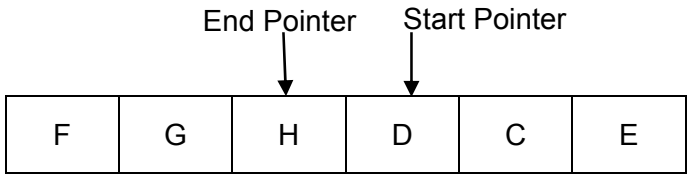
Question	Answer	Marks

4(b)(ii)	1 mark per bullet point
	
	• Initialising a counter variable to 0 **and** must be the same variable used to access array elements
	• While loop checking counter is < 5 or <= 4
	• Incrementing counter inside the loop and outside IF, **and** remainder of algorithm completed (The IF to ENDIF)
	
	e.g.
	
	`Count ← 0`
	`WHILE Count < 5`
	`  IF ArrayData[Count] > ArrayData[Count + 1]`
	`  THEN`
	`  TempValue ← ArrayData[Count + 1]`
	`  ArrayData[Count + 1] ← ArrayData[Count]`
	`  ArrayData[Count] ← TempValue`
	`  Sorted ← False`
	`  ENDIF`
	`  Count ← Count + 1`
	`ENDWHILE`
		3

4(b)(iii)	Bubble sort	**1**
4(b)(iv)	One from: • Insertion sort • Merge sort • Quick sort	**1**

QUESTION 15.

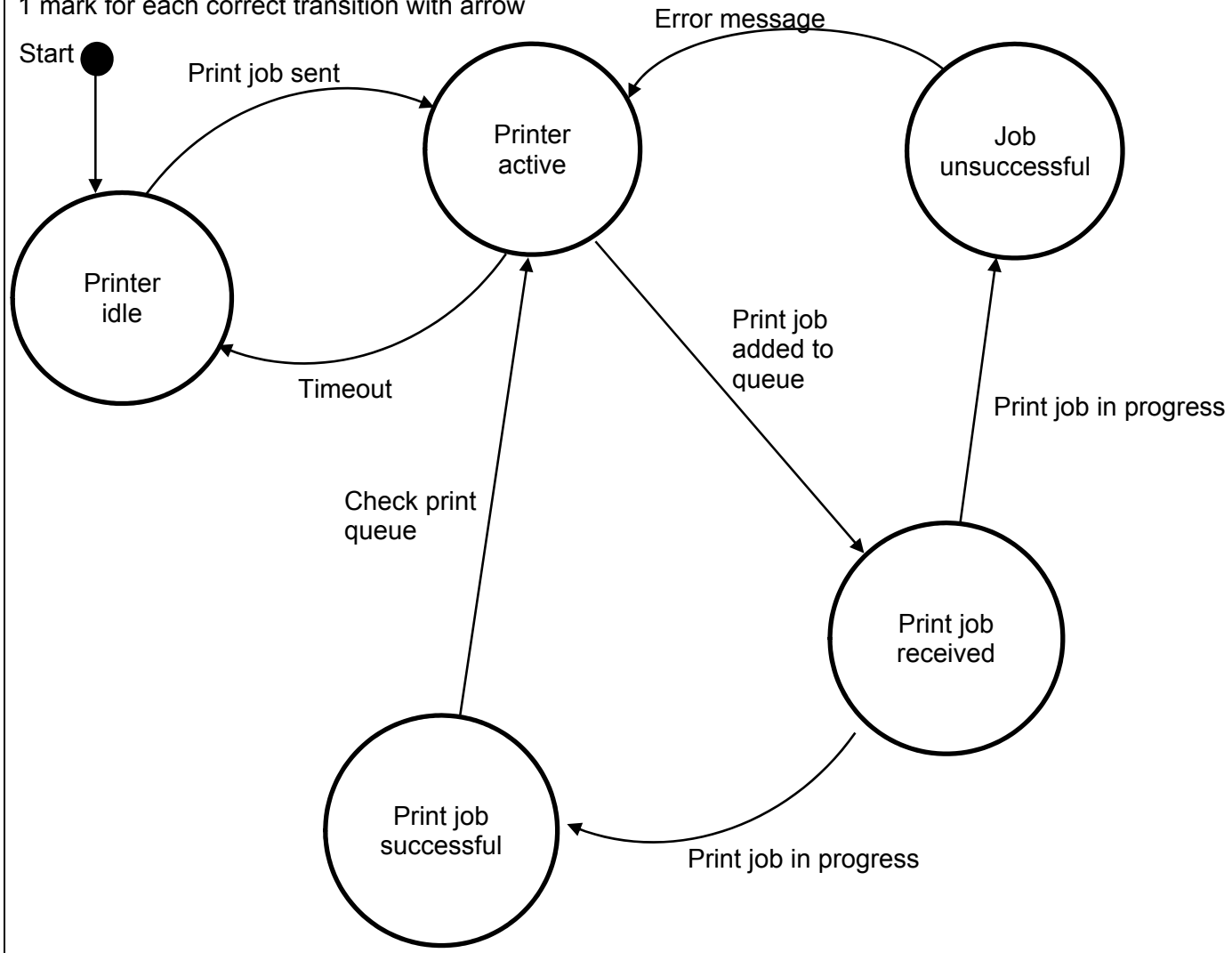
Question	Answer	Marks
1(a)(i)	 1 mark for each correct Activity and time • B 3 • C 10 (following B) • D 7 (following B) • E 3 (following C and D) • G 2 (following F) • H 2 (following F)	**6**
1(a)(ii)	The shortest time to complete the project // the sequence of activities that must be completed to avoid delaying the project	**1**
1(a)(iii)	1 mark for identify, max 1 for description • GANTT • A table that has time across the top and activities on the left, boxes are coloured to show dependencies and find critical path // colour in the boxes to show the length of time for each task	**2**

Question	Answer	Marks
1(b)(i)	A, B, C and D in correct places with no alteration to start and end pointer 	**1**
1(b)(ii)	1 mark per bullet point • correct jobs in correct order… • … correct location of start pointer • … correction location of new end pointer 	**3**
1(b)(iii)	1 mark from: • An error **message** would be generated	**1**

Question	Answer	Marks

1(b)(iv)	1 mark for each correct line
	
	`FUNCTION Remove RETURNS STRING`
	`  DECLARE PrintJob : STRING`
	`  IF StartPointer = EndPointer`
	`   THEN`
	`     RETURN "Empty"`
	`   ELSE`
	`     PrintJob ← Queue[StartPointer]`
	`     IF StartPointer = 5`
	`       THEN`
	`        StartPointer ← 0`
	`       ELSE`
	`        StartPointer ← StartPointer + 1`
	`      ENDIF`
	`     RETURN PrintJob`
	`   ENDIF`
	`ENDFUNCTION`
		4

1(b)(v)	1 mark per bullet point • A stack is Last In First Out (LIFO) while a queue is First In First Out (FIFO) • The queue removes and returns the element at **start pointer** // item is removed from the **start/head //** • A stack would remove and return the element at **end pointer** // item is removed from the **end**	**2**

Question	Answer	Marks
1(c)	1 mark for each correct transition with arrow 	5

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(d)(i)</td><td>1 mark per bullet
• Way of modelling logic
• Show all possible outputs // shows every possible outcome // all outcomes …
• … based on the inputs
• Determine which action to take in specific conditions // how different conditions affect the actions/outcomes</td><td>2</td></tr>
<tr><td>1(d)(ii)</td><td>1 mark for each row

Accept Y/X/ticks as long as clear which are Y. Accept N/X/– for empty spaces

<table>
<tr><th></th><th></th><th colspan="8">Rules</th></tr>
<tr><td rowspan="3">Conditions</td><td>Document printed, but quality is poor</td><td>Y</td><td>Y</td><td>Y</td><td>Y</td><td>N</td><td>N</td><td>N</td><td>N</td></tr>
<tr><td>Error light is flashing on printer</td><td>Y</td><td>Y</td><td>N</td><td>N</td><td>Y</td><td>Y</td><td>N</td><td>N</td></tr>
<tr><td>Document printed, but paper size is incorrect</td><td>Y</td><td>N</td><td>Y</td><td>N</td><td>Y</td><td>N</td><td>Y</td><td>N</td></tr>
<tr><td rowspan="4">Actions</td><td>Check connection from computer to printer</td><td></td><td></td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>Check ink status</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Check if there is a paper jam</td><td></td><td></td><td></td><td></td><td></td><td>X</td><td></td><td></td></tr>
<tr><td>Check paper size selected</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td></tr>
</table>
</td><td>4</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(d)(iii)</td><td>1 mark each for each correct column

Accept –/X for empty spaces. Accept Y/X/Ticks as long as clear which are used

<table>
<tr><th></th><th></th><th colspan="8">Rules</th></tr>
<tr><td rowspan="3">Conditions</td><td>Document printed, but quality is poor</td><td>Y</td><td>Y</td><td>N</td><td>N</td><td>N</td><td></td><td></td><td></td></tr>
<tr><td>Error light is flashing on printer</td><td></td><td></td><td></td><td>Y</td><td>N</td><td></td><td></td><td></td></tr>
<tr><td>Document printed, but paper size is incorrect</td><td>Y</td><td>N</td><td>Y</td><td>N</td><td>N</td><td></td><td></td><td></td></tr>
<tr><td rowspan="4">Actions</td><td>Check connection from computer to printer</td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Check ink status</td><td>X</td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Check if there is a paper jam</td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Check paper size selected</td><td>X</td><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>5</td></tr>
</table>

Question	Answer	Marks

1(e)(i)	1 mark per bullet point to **max 4**
	
	• Method header and close (where necessary) with three parameters
	• Initialised `PrintID`, `FirstName`, `LastName` and `Credits` …
	• … to the parameters
	• Initialised `Credits` to 50
	
	PYTHON
	`def__init__(self, NewFN, NewLN, NewPrintID):`
	`  self.__PrintID = NewPrintID`
	`  self.__FirstName = NewFN`
	`  self.__LastName = NewLN`
	`  self.__Credits = 50`
	
	PASCAL
	`Constructor NewPrintAccount.Create(NewFN, NewLN, NewPrintID);`
	`begin`
	`  PrintID := NewPrintID;`
	`  FirstName = NewFN;`
	`  LastName = NewLN;`
	`  Credits := 50;`
	`end;`
	
	VB
	`Public Sub New(NewFN, NewLN, NewPrintID As String)`
	`  PrintID = NewPrintID`
	`  FirstName = NewFN`
	`  LastName = NewLN`
	`  Credits = 50`
	`End Sub`
		4

Question	Answer	Marks

1(e)(ii)	1 mark per bullet point
	
	• method/procedure header (and close where appropriate) taking a parameter
	• `FirstName` is set to **parameter**
	
	PYTHON
	`def __SetFirstName(self, NewFirstName):`
	`  self.__FirstName = NewFirstName`
	
	PASCAL
	`procedure SetFirstName(newFirstName : String);`
	`begin`
	`  FirstName := newFirstName;`
	`end;`
	
	VB
	`public sub SetFirstName(NewFirstName As String)`
	`  FirstName = NewFirstName`
	`End Sub`
		2

Question	Answer	Marks

1(e)(iii)	1 mark per bullet point
	
	• concatenates `FirstName`, space and `LastName` …
	• … function/method header without parameter **and** returns (generated) value
	
	PYTHON
	`def __GetName(self):`
	`  return(self.__FirstName + " " + self.__LastName)`
	
	PASCAL
	`function GetName();`
	`begin`
	`  result := FirstName + " " + LastName`
	`end;`
	
	VB
	`public function GetName() As String`
	`  return(FirstName & " " & LastName)`
	`End Function`
		2

Question	Answer	Marks

1(e)(iv)	1 mark per each correct bullet point from:
	• **Procedure**/method header and close (where necessary) passing MoneyInput
	• At least **3** constants (e.g. `freecredit10`, `freecredit20`, `twenty`, `10`, `creditperdollar`)
	• If `MoneyInput<10` calculate `MoneyInput * 25`
	• If `MoneyInput >9` and `MoneyInput <20` then calculate `MoneyInput * 25 + 25`
	• If `MoneyInput >19` then calculate `MoneyInput * 25 + 50`
	• All **three** correct calculations add to `Credits`, not overwrite
	• Efficient IF (i.e. elseif)
	
	PYTHON
	`def __AddCredits(self, MoneyInput):`
	`  CreditPerDollar = 25`
	`  FreeCredit10 = 25`
	`  FreeCredit20 = 50`
	`  Twenty = 20`
	`  Ten = 10`
	`  if MoneyInput >= Twenty:`
	`  Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit20`
	`  elif MoneyInput >= Ten:`
	`  Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit10`
	`  else:`
	`  Credits = Credits + (MoneyInput * CreditPerDollar)`
		6

Question	Answer	Marks

1(e)(iv)	PASCAL
	`procedure AddCredits(MoneyInput : Real);`
	`  const CreditPerDollar = 25`
	`  const FreeCredit10 = 25`
	`  const FreeCredit20 = 50`
	`  const Twenty = 20`
	`  const Ten = 10`
	`begin`
	`  If MoneyInput > = Twenty Then`
	`  Credits := Credits + (MoneyInput * CreditPerDollar) + FreeCredit20;`
	`  Else If MoneyInput > = Ten Then`
	`  Credits := Credits + (MoneyInput * CreditPerDollar) + FreeCredit10;`
	`  Else`
	`  Credits := Credits + (MoneyInput * CreditPerDollar);`
	`end;`
	
	VB.NET
	`Public Sub AddCredits(MoneyInput As Integer)`
	`  Const CreditPerDollar As Integer = 25`
	`  Const FreeCredit10 As Integer = 25`
	`  Const FreeCredit20 AS integer = 50`
	`  Const Twenty As Integer = 20`
	`  Const Ten AS Integer = 10`
	`  If MoneyInput > = Twenty Then`
	`  Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit20`
	`  Else If MoneyInput > = Ten Then`
	`  Credits = Credits + (MoneyInput * CreditPerDollar) + FreeCredit10`
	`  Else`
	`  Credits = Credits + (MoneyInput * CreditPerDollar)`
	`  End If`
	`End Sub`	

Question	Answer	Marks
1(e)(v)	1 mark per bullet • Declaring `StudentAccounts` as array of 1000 elements… • …of type `PrintAccount` `DECLARE StudentAccounts ARRAY[0:999] OF PrintAccount`	**2**

Question	Answer	Marks

1(e)(vi)	1 mark per bullet point to **max 8**
	
	• Generating ID with '1' at the end all in **lowercase** from parameters
	
	• Loop through array to last occupied element …
	• … Check if the `PrintID` already exists
	• … using `GetPrintID()`
	• … increment number at end of `PrintID`
	
	• Create a new instance of `PrintAccount` …
	• … sending `FirstName`, `LastName`, `PrintID` as parameters
	• adding new account to `StudentAccounts` at position `NumberStudents`
	• Increment `NumberStudents`
	
	VB.NET
	`Sub CreateId(firstName, lastName)`
	`  Dim count As Integer`
	`  Dim PrintID = Left(firstname, 3).ToLower & Left(lastname, 3).ToLower & "1"`
	`  Dim studentAdd As Integer = 0`
	`  If numberStudents <> 0 Then`
	`    For x = 0 To numberStudents - 1`
	`      If studentAccounts(x).getPrintID() = username Then`
	`        PrintID = PrintID + 1`
	`        username = Left(firstname, 3).ToLower & Left(lastname, 3).ToLower & PrintID.ToString`
	`       End If`
	`     Next`
	`     studentAdd = numberStudents`
	`   End If`
	`   studentAccounts(studentAdd) = New printAccount(firstname, lastname, username)`
	`   numberStudents = numberStudents + 1`
		8

Question	Answer	Marks

1(e)(vi)	**Python**
	`def CreateID(firstname, lastname):`
	`  count = 0`
	`  PrintID = firstname[0:3].lower() + lastname[-3].lower() + "1"`
	`  StudentAdd = 0`
	`  if numberStudents != 0:`
	`  for x in range(0, numberStudents):`
	`  if studentAccounts[x].getPrintID() == username:`
	`  PrintID = PrintID + 1`
	`  username = firstname[0:3].lower() + lastname[0:3].lower + str(PrintID)`
	`  studentAdd = numberStudents`
	`  studentAccounts[studentAdd] = printAccount(firstname, lastname, username)`
	`  numberStudents = numberStudents + 1`
	
	Pascal
	`procedure CreateID(firstname : String, lastname: String);`
	`  var`
	`  count : Integer;`
	`  studentAdd : Integer;`
	`  PrintID : String;`
	
	`begin`
	`  studentAdd := 0;`
	`  PrintID := LowerCase(substr(firstname,0,3)) + LowerCase(substr(lastname,0,3))+ "1";`
	`  if numberStudents <> 0:`
	`  ror x := 0 To numberStudents - 1;`
	`  if studentAccounts[x].getPrintID() = username:`
	`  PrintID := PrintID + 1;`
	`  username := LowerCase(substr(firstname, 3) +`
	`LowerCase(substr(lastname,0,3))+str(PrintID);`
	
	`  studentAdd := numberStudents;`
	`studentAccounts[studentAdd] := printAccount.Create(firstname, lastname, username);`
	`numberStudents := numberStudents + 1`	

QUESTION 16.

Question	Answer	Marks

2(a)	1 mark per completed statement
	
	`FUNCTION AddToQueue(Number : INTEGER) RETURNS BOOLEAN`
	`  CONSTANT FirstIndex = 0`
	`  CONSTANT LastIndex = 7`
	`  TempPointer ← EndPointer + 1`
	`  IF TempPointer > LastIndex`
	`   THEN`
	`    TempPointer ← FirstIndex`
	`  ENDIF`
	`  IF TempPointer = StartPointer`
	`   THEN`
	`     RETURN FALSE`
	`   ELSE`
	`    EndPointer ← TempPointer`
	`    NumberQueue[EndPointer] ← Number`
	`    RETURN TRUE`
	`  ENDIF`
	`ENDFUNCTION`
		5

2(b)	1 mark per bullet point 1 mark for: • … if the start pointer reaches the end of the queue, it becomes the index of the first element in the queue **Max 3** from: • Checks if the circular queue is empty // Checks if the queue has any data in it • … if it is empty it **reports** that it is empty • If not empty, return the value at the position of the **start pointer** … • … then increments the start pointer	**4**

Question	Answer	Marks
2(c)	1 mark per bullet point to **max 3** e.g. • Stack • Linked list • Dictionary • (Binary) tree	**3**

Question	Answer	Marks
3(a)	1 mark per test data type • Normal / valid • Abnormal / erroneous / invalid • Boundary / extreme	**3**
3(b)(i)	1 mark for each name **Description** / **Name of debugging feature** A point where the program can be halted to see if the program works to this point / **Breakpoint** One statement is executed and then the program waits for input from the programmer to move to the next statement. / **Stepping // step through/over/into**	**2**
3(b)(ii)	1 mark for name, 1 for description e.g. • variable watch window • observe how variables change during execution // view current status of variables • Error list • describes the error // gives line number of error	**2**