GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

FEB / MAR 2006

COMPUTER STUDIES HG
(Second Paper: Theory)

TIME: 3 hours

MARKS: 200

INSTRUCTIONS:

- Answer ALL the questions.
- Read the questions thoroughly.
- This paper consists of 20 pages. Check that your paper is complete.
- Number your answers clearly.
- The programming section consists of Delphi and Pascal questions. Answer EITHER the Pascal OR the Delphi questions.
- Pascal coding may be done in pencil.

QUESTION 1
DATA REPRESENTATION

1.1 Write down the simplified function from the Karnaugh diagram.

	Y' 00	**Y' 01**	**Y 11**	**Y 10**	
W' 00	1		1	1	***X'***
W' 01		1			**X**
W 11		1	1		***X***
W 10		1	1		**X'**
	Z'	**Z**	**Z**	**Z'**	

(5)

1.2 Solve the following Boolean equation algebraically:
F(w,x,y) = wxy + wx'y + w'xy + x'y (4)

1.3 1.3.1 Design a truth table for the following problem:
A circuit contains three switches and a light. The light burns if two or more switches are on. (4)

1.3.2 Write the function in Question 1.3.1 as the sum of min terms in the *m-notation*. (2)

[15]

QUESTION 2
COMPUTER ARCHITECTURE

2.1 Give ONE word for each of the following descriptions. (Choose from: USB, *IrDA* Parallel, SCSI, Bluetooth, Serial, Firewire, *MIDI*).

2.1.1 A type of interface connecting a device with a system that transfers data bit by bit

2.1.2 A type of serial port enabling high-speed transfer – 400 Mgps – of data to devices

2.1.3 A standard, high-speed parallel interface to connect peripherals to a computer, for example a hard disk

2.1.4 A serial port specification that allows up to 127 devices to be connected to the computer

2.1.5 A wireless network system based on high-frequency radio signals with a limited range

2.1.6 A type of interface connecting devices by simultaneously transmitting more than 1 bit (6)

2.2 Arrange the following buses according to their speed of data transfer, from the fastest to the slowest.

A. AGP bus
B. ISA bus
C. PCI bus (2)

2.3 The plug-in slots on a motherboard determine which type of card can be added to your computer. Indicate at each plug-in slot the type of device that it can be connected to.

2.3.1 ISA
2.3.2 PCI
2.3.3 AGP (3)

2.4 Which TWO internal buses have an influence on the processing speed of a computer? (2)

2.5 Indicate in a table TWO differences between the RISC and CISC instruction sets. (2)

2.6 The following table gives an indication of the number of transistors contained in each type of processor.

Processor	Clock speed	Number of transistors
Xeon	1.4 – 2.8 GHz	140 million
Pentium 4	1.4 – 3.06 GHz	42 – 55 million
Pentium III	400 MHz – 1.4 GHz	9.5 – 28 million
Pentium II	234 – 450 MHz	7.5 million
Pentium with MMX technology	166 – 233 MHz	4.5 million
Pentium I	75 – 200 MHz	3.3 million

2.6.1 Discuss briefly the influence of the following factors on the performance of the computer:

(a) Number of transistors
(b) Size of transistors (4)

2.6.2 Extra instructions were added to the MMX-type processors allowing the processors to work effectively with video and 3D graphics. What are these instructions known as? (1)

2.6.3 What is the function of the system clock? (1)

2.6.4 The system clock and the processor differ in speed. What is the speed of modern system clocks? (1)

2.6.5 What is **clock multiplication**? (2)

2.6.6 Name the storage unit that forms part of the CPU that temporarily stores data and instructions. (1)

2.6.7 What is meant by the statement: **A processor is super scalar**? (1)

2.6.8 Discuss pipeline processing and the influence of it on the processor. (3)

2.6.9 It is not always necessary to buy a new computer; one can simply upgrade the existing processor. What must one, however, keep in mind? (1)

2.7 Write down the type of memory of the following:

2.7.1 This is a high-speed memory reserved for the temporary storage of data and instructions most likely to be used next by the processor.

2.7.2 The memory can be refreshed when the CPU is not occupied with data transfer.

2.7.3 It doubles the data rate of the RAM because it can send twice in one clock tick.

2.7.4 The type of memory used in digital cameras.

2.7.5 This type of memory usually contains a program called BIOS. (5)

[35]

QUESTION 3
SYSTEM SOFTWARE

3.1 3.1.1 What is the difference between a peer to peer and a client-server network? (2)

3.1.2 Give an example of a network operating system that supports a (a) peer to peer and (b) a client-server network. (2)

3.2 Name ONE device that uses an embedded operating system. (1)

3.3 What is the purpose of utility facilities built into operating systems? (1)

3.4 Name TWO advantages of each of the following:

3.4.1 *File compression utility* (2)

3.4.2 *Open source* (2)

3.5 Why are backups necessary? (1)

3.6 What is the function of a print spooler? (2)

3.7 Name any TWO signs that will indicate that a computer is possibly contaminated with a virus. (2)

3.8 Consider the following example: The operating system needs 128 MB RAM, a graphic program 40 MB RAM and an integrated suite 32 MB. A total therefore of 200 MB. The computer only has 128 MB RAM. Give a short description of how the computer solves this problem. (3)

3.9 Explain what **multi-task processing** is. (2)

[20]

QUESTION 4
DATA COMMUNICATION

4.1 There are two types of dedicated lines, namely digital and analogue. Discuss the difference between the two lines by referring to data transfer speed and reliability. (2)

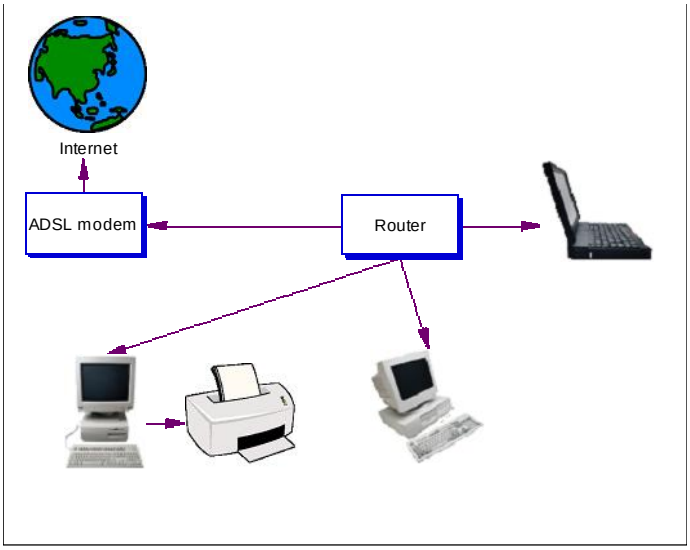
4.2 Give THREE characteristics of an ISDN line. (3)

4.3 4.3.1 Name THREE physical and THREE wireless communication media. (6)

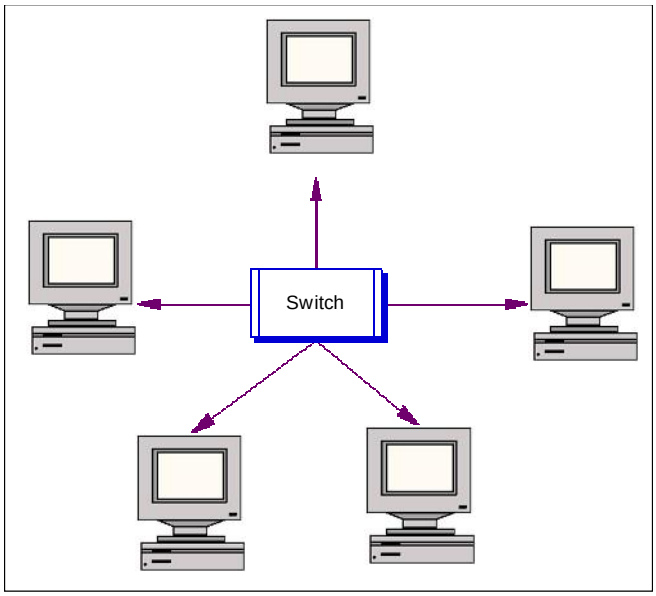
4.3.2 Name THREE situations where the use of wireless media are especially useful. (3)

4.4 Consider the following network layouts and then answer the questions:

Network A



Network B



4.4.1 Consider the layout of network **A** and give TWO advantages of the use of a network. (2)

4.4.2 Name THREE functions of a router that a switch does not have. (3)

4.4.3 What does the term **topology** mean? (1)

4.4.4 Which topology is used in network **B**? (1)

4.4.5 Briefly describe the CSMA/CD access method. (3)

4.4.6 Discuss THREE outstanding characteristics of an ADSL line. (3)

4.4.7 Why is ASDL technology especially suitable for Internet use? (2)

4.4.8 Name the switching technique used by network **A** to send data over a wide area. (1)

[30]

QUESTION 5
SOCIAL IMPLICATIONS AND THE INTERNET

5.1 The following two statements refer to two problems, namely a computer crime and an issue concerning computer ethics. What are these two problems and state the reason at each why it is not allowed?

5.1.1 Copy Delphi 7 that you borrow from a classmate so that you can practise Delphi at home.

5.1.2 A company gives information about its clients to a third party. (4)

5.2 Define each of the following terms:

5.2.1 Biometrics

5.2.2 Encryption

5.2.3 Digital signature

5.2.4 Digital certificate

5.2.5 Computer virus

5.2.6 *Firewall* (12)

5.3 Using an example, briefly describe what comprises each of the following two error checking techniques: Parity Checking and Checksum. (4)

5.4 Describe how a computer can be infected with a virus through e-mail. (1)

5.5 5.5.1 What is the software called that one needs to access information on the Internet? Give an example of such a program. (2)

5.5.2 What are **Yahoo**, **Altavista** and **Google** and what function do they perform? (2)

[25]

ANSWER EITHER THE DELPHI OR THE PASCAL QUESTIONS.

DELPHI

QUESTION 6
FUNCTIONS AND PROCEDURES

Consider the following program that converts an 8 bit binary number to a hexadecimal, i.e. 10011111 = 9F.

```
unit hexa_u;

interface

uses
  Windows, Messages, SysUtils, Variants, Classes, Graphics,
Controls, Forms, Dialogs, Buttons, StdCtrls, ComCtrls;

type
  TfrmConverts = class(TForm)
    edtNumber: TEdit;
    lblOutput: TLabel;
    edtKeyin: TLabel;
    btnChange: TButton;
    bmbClose: TBitBtn;
    bmbRetry: TBitBtn;

procedure btnConvertsClick(Sender: TObject);

private
    { Private declarations }
public
    { Public declarations }
end;

type
  str4 = string[4];
  str1 = string[1];

var
  frmConverts: TfrmConverts;

implementation

{$R *.dfm}
```

```
procedure converts(cWrd:str4; var cNumber:byte);
var
  iTimes, iBinn, k, iErrcode :integer;
begin
 iTimes := 8;
 cNumber := 0;
 for k := 1 to 4 do
 begin
          val(cWrd[k],iBinn,iErrcode);
          cNumber := cNumber + iBinn*iTimes;
          iTimes := iTimes div 2;
  end;
end;

function changeoversingledigit(cNumber:byte):str1;

{6.2 Complete this part}

end;

procedure TfrmConverts.btnConvertsClick(Sender: TObject);
var
   bNumber  :byte;
   sBinnumb :string[8];
   j        :integer;
   sLetter  :str1;
   sJoin    :string[2];

begin
  sBinnumb := edtNumber.Text;
  for j := 1 to 2 do
  begin
    if j = 1 then sJoin := '';
      converts(copy (sBinnumb,1,4),bNumber);
      sLetter := changeoversingledigit(bNumber);
      sJoin := sJoin + sLetter;
      delete(sBinnumb,1,4);
   end;
   lblOutput.caption := sJoin;
end;
end.
```

6.1 The `converts` procedure converts four binary digits to a decimal number, for example:

1001 to 9
1111 to 15 etc.

6.1.1 There are two integer data types in the procedure. Name another integer data type. (1)

6.1.2 Explain the function of the parameter `iErrcode` in the val procedure. (2)

6.1.3 May the data type `str4` be replaced by `string[4]` in the parameter list? Substantiate your answer. (2)

6.1.4 May the variable data type `iTimes` be changed to REAL? Substantiate your answer. (2)

6.1.5 Distinguish between **value** and **reference parameters** by giving examples from the procedure. (2)

6.2 Complete the function `changeoversingledigit` that changes the decimal value to a single letter. It is done as follows:

0 to 9 stays the same
10 is changed to A
11 is changed to B
12 is changed to C
13 is changed to D
14 is changed to E
15 is changed to F (6)

6.3 Which ONE of the call statements will NOT give a fault message? Refer to the given program.

```
A.    converts('0111',' ');
B.    converts('1011',bNumber);
C.    converts(1011,'4');
D.    converts(bNumber,copy(sBinnumb,1,4));
```
(1)

6.4 What is the difference between **global** and **local variables**? (2)

[18]

QUESTION 7
ONE AND TWO DIMENSIONAL ARRAYS

DELPHI

7.1 Use the given headings of the trace table to determine the output of the following program segment.

```
procedure TForm1.btnBerekenClick(Sender: TObject);

var
  iNumb,ik,ix    :integer;
  aArray         :array[1..10] of integer;

begin
 iNumb := 10;
 ik := 0;
 While iNumb > 0 do
 begin
    ik := ik + 1;
    aArray[ik] := iNumb*ik;
    dec(iNumb,3);
 end;
 For ix := 1 to ik - 1 do
    redAfvoer.Lines.Add(intToStr(aArray[ix]));
end;
```

ik	iNumb	iNumb > 0	aArray

(7)

7.2 The following declaration statements are given:

```
var
aElement     :array[1..80] of integer;
iNumber      :integer; // number of elements in the array
iMiddle      :integer;
```

Now write the program code to determine the middle value of a sorted set of numbers. If there is an even set of numbers the average of the two middle values must be determined. Examples:

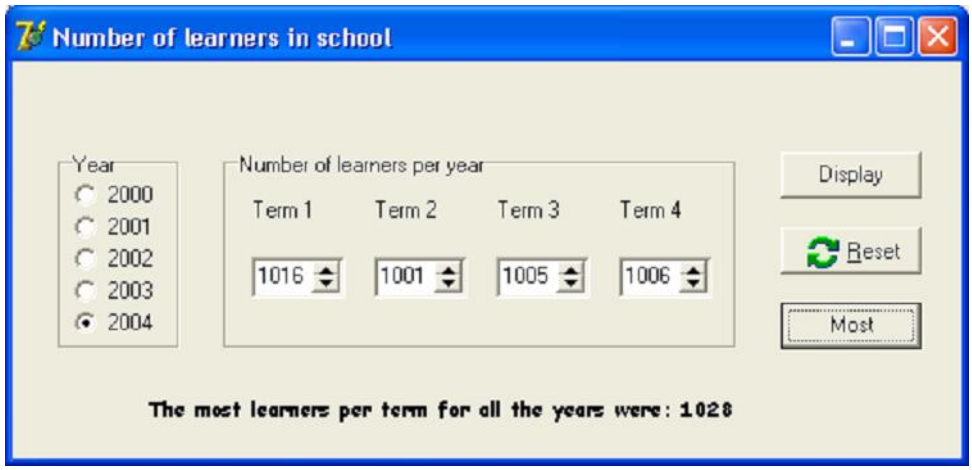
1 12 34 64 71: The middle value is 34
6 18 20 25 30 32 40 42 78 91: The middle value is 31((i.e. 30 +32)/2) (5)

7.3 The following table displays the number of learners per term for a specific year. The data is read into a two-dimensional array.

	Term 1	**Term 2**	**Term 3**	**Term 4**
2000	1006	1001	998	999
2001	1010	1007	1012	1014
2002	1115	1119	1117	1113
2003	1028	1001	1005	1006
2004	1016	1001	1005	1006

7.3.1 Give the declaration for the two-dimensional array. (2)

7.3.2 Complete the statements (A) to (E). The event handler for btnDisplay, displays the number of learners for a specific year.




```
procedure TfrmNumbers.btnDisplay(Sender: TObject);
var
  year :integer;

begin
     case  ( A ) of
       0 :  year := 2000;
       1 :  year := 2001;
       2 :  year := 2002;
       3 :  year := 2003;
       4 :  year := 2004;
     end;
     sedT1.Value := ( B );
     sedT2.Value := ( C );
     sedT3.Value := ( D );
     sedT4.Value := ( E );

  end;
```

Component	Name
Form	frmNumbers
Button1	btnDisplay
Button2	btnMost
Bitbtn1	bmbReset
Groupbox1	gpbNumbers
Label1	lblT1
Label2	lblT2
Label3	lblT3
Label4	lblT4
Spinedit1	sedT1
Spinedit2	sedT2
Spinedit3	sedT3
Spinedit4	sedT4
Label5	lblMost
Radiogroup1	rgpYear

(3)

7.3.3 Complete the following procedure that determines the most learners per term for all the years and show the result.

```
procedure TfrmNumbers.btnMostClick(Sender: TObject);
var
 x,y, iLargest :integer;
begin

{ Complete this part }

end;
```

(5)
[22]

QUESTION 8
DATA FILES

DELPHI

8.1 What is the function of each of the following statements with respect to file processing?

8.1.1 AssignFile
8.1.2 Reset
8.1.3 Rewrite
8.1.4 Read
8.1.5 Seek
8.1.6 FileSize
8.1.7 Write
8.1.8 Filepos (8)

8.2 Consider the following program segment and then answer the questions.

```
Procedure TfrmDataInlees.btnVertoonClick(Sender:Tobject);
Begin
 Reset(DataFile)
 Try
 Repeat
   Read(DataFile, Data);
   lstTipe.Items.Add(Data.sName + '   ' + Data.sSurname);
 until eof(DataFile);
 Finally
 CloseFile(DataFile);
End;
End;
```

8.2.1 Describe what the program segment does. (2)

8.2.2 What is the purpose of the *Try – Finally* statement? (2)

8.2.3 Write down the name of the record variable. (1)

8.3 What is the purpose of the FileExists function in the program segment?

```
AssignFile(DataFile,'DATA.DAT');
if FileExists('DATA.DAT') = true then
begin
   Reset(DataFile);
   Seek(DataFile, FileSize(DataFile));
end
else                                                    (2)
   Rewrite(DataFile)
```

[15]

QUESTION 9
DELPHI

9.1 Which component can be associated with each of the following descriptions?

9.1.1 The component that gives the user a True/False choice by selecting or not selecting that component.

9.1.2 The component used to read in a string.

9.1.3 The component that displays more than one line of text.

9.1.4 The component that allows the user the choice of only one option. (4)

9.2 Write the Delphi code to choose a random number from 1 to 100 and to assign it to a variable `iNumber`. (2)

9.3 Each of the following statements is wrong. Correct the statement or explain what is wrong with it.
The declaration of variables is as follows:

```
Var
   eAverage    :extended;
   rValue      :real;
```

9.3.1
```
lblOutput.Caption := edtName + ' your average percentage
  is ' + eAverage;
```
(2)

9.3.2
```
if grpChoice.Itemindex = false then inc(rValue);
```
(2)

[10]

QUESTION 10
DELPHI

Write a Delphi program that counts the number of letters and digits in a word. Use the given components and form and complete the event handler for **btnDetermine**. (10)

Component	Name
Form1	frmQUESTION10
Bitbtn1	bmbClose
Button1	btnDetermine
Edit1	edtWord
Edit2	edtLetters
Edit3	edtDigit
Label1	lblWord
Label2	lblLetters
Label3	lblDigit

[10]

[10]

TOTAL: 200

OR

QUESTION 6
FUNCTIONS AND PROCEDURES

PASCAL

Consider the following program that converts an 8 bit binary number to a hexadecimal i.e. 10011111 = 9F.

```
program exam;

uses crt;
type
  str4 = string[4];
  str1 = string[1];
var
   number   :byte;
   binnumber:string[8];
   j        :integer;
   letter   : str1;
   join     : string[2];

procedure converts(cword:str4; var cnumber:byte);
var
  times, binnumb, k, errcode :integer;
begin
 times := 8;
 cnumber := 0;
 for k := 1 to 4 do
 begin
       val(cword[k],binnumb,errcode);
       cnumber := cnumber + binnumb*times;
       times := times div 2;
  end;
end;

function changeoversingledigit(cnumber:byte):str1;

{6.2 Complete this part}

end;

begin
  writeln('Enter the binary number');
  readln(binnumber);
  join := '';
  clrscr;
  write(binnumber,'');
  for j := 1 to 2 do
  begin
   converts(copy(binnumber,1,4),number);
   letter := changeoversingledigit(number);
   join := join + letter;
```

```
  delete(binnumber,1,4);
  end;
  writeln(' converts to hexadecimal is ',join);
  readln;
end.
```

6.1 The `converts` procedure, converts four binary digits to a decimal number i.e.
1001 to 9
1111 to 15, etc.

6.1.1 There are two integer data types in the procedure. Name another integer data type. (1)

6.1.2 Explain the function of the parameter `errcode` in the val procedure. (2)

6.1.3 May the data type `str4` be replaced by `string[4]` in the parameter list? Substantiate your answer. (2)

6.1.4 May the data type of the variable `times` be changed to REAL? Substantiate your answer. (2)

6.1.5 Distinguish between **value** and **reference parameters** by giving examples from the procedure. (2)

6.2 Complete the function `changeoversingledigit` that changes the decimal value to a single letter. It is done as follows:

0 to 9 stays the same
10 is changed to A
11 is changed to B
12 is changed to C
13 is changed to D
14 is changed to E
15 is changed to F (6)

6.3 Which ONE of the call statements will NOT give a fault message? Refer to the given program.

```
A.    converts('0111',' ');
B.    converts('1011',number);
C.    converts(1011,'4');
D.    converts(number, copy(binnumb,1,4));
```
(1)

6.4 What is the difference between **global** and **local variables**? (2)

[18]

QUESTION 7
ONE AND TWO DIMENSIONAL ARRAYS

PASCAL

7.1 Use the given headings of the trace table to determine the output of the following program segment.

```
program example;
uses crt;

var
  number, k, x  :integer;
  Arr           :array[1..10] of integer;
begin
number := 10;
k := 0;
While number > 0 do
begin
   k := k + 1;
   Arr[k] := number*k;
   dec(number,3);
end;
For x := 1 to k - 1 do
   Writeln(Arr[x]);
readln;
end.
```

k	Number	number > 0	Arr

(7)

7.2 The following declaration statements are given:

```
var
     element  :array[1..80] of integer;
     number   :integer; {number of elements in the array}
     middle   :integer;
```

Now write the program code to determine the middle value of a sorted set of numbers. If there is an even set of numbers then the average of the middle value must be determined. Examples:

1 12 34 64 71: The middle value is 34
6 18 20 25 30 32 40 42 78 91: The middle value is 31((i.e. 30 + 32)/2) (5)

7.3 The following table displays the number of learners per term for a specific year. The data is read into a two-dimensional array.

	Term 1	**Term 2**	**Term 3**	**Term 4**
2000	1006	1001	998	999
2001	1010	1007	1012	1014
2002	1115	1119	1117	1113
2003	1028	1001	1005	1006
2004	1016	1001	1005	1006

7.3.1 Give the declaration for the two-dimensional array. (2)

7.3.2 Complete the program segment that displays the number of learners for a specific year, for example:

```
                Year: 2004
1016        1001          1005        1006

writeln('Which year do you want to display?');
readln(year);
```
(3)

7.3.3 Write a program segment that determines the most learners per term for all the years and show the result.

Example of output:

```
The most learners per term for all the years were 1028.
```
(5)
[22]

QUESTION 8
DATA FILES

PASCAL

8.1 What is the function of each of the following statements with respect to file processing?

8.1.1 Assign
8.1.2 Reset
8.1.3 Rewrite
8.1.4 Read
8.1.5 Seek
8.1.6 FileSize
8.1.7 Write
8.1.8 Filepos (8)

8.2 Consider the following program segment and then answer the questions.

```
 Assign(DataFile,'DATA.DAT');
 Reset(DataFile)
 Repeat
   Read(DataFile, Data);
   Writeln(Data.Name + '   '  + Data.Surname);
 until eof(DataFile);
 Close(DataFile);
End;
```

8.2.1 Describe what the program segment does. (2)

8.2.2 Write down the name of the record variable. (1)

8.2.3 The error message "Disk read Error" is displayed when the program is executed. What can possibly be the cause? (2)

8.3 What is the purpose of the translator directive in the program segment?

```
Assign(DataFile,'DATA.DAT');
{$I-}
Reset(DataFile);
     ErrorCode := IOResult
{$I+}
if ErrorCode <> 0 then Rewrite(DataFile)
  else
Seek(DataFile, FileSize(DataFile));
```

(2)

[15]

QUESTION 9

PASCAL

9.1 Write Pascal statements for the following:

9.1.1 The computer must make a sound for two seconds. (2)

9.1.2 Shift the marker to the right-hand lowest corner of the screen. (2)

9.1.3 Erase an entire line. (1)

9.1.4 Choose a random number from 1 to 100 and assign it to a variable number. (2)

9.2 Complete the program segment that prints a vertical list of names, surnames and ages, e.g.

Trevor	Tlokane	17
Martin	Maritz	18
Ilze	Schoeman	17

Use the following declaration:

```
type
 recordtype = record
     name, surname :string[20];
     age :integer;
 end;
var
 person   :recordtype;
 DatFile  :file of recordtype;
 k        :integer;
begin
 . . . . . .
for k := 1 to filesize(DatFile) do
begin
   read(DatFile,person);
   writeln(  { Complete this part} );
end;
```

(3)

[10]

QUESTION 10
PASCAL

Write a complete program that counts the number of letters and digits in a word.

Input: Bed45a1
Output: Letters: 4 Digits: 3

[10]

TOTAL: 200

END