

You are allowed ten minutes before the start of the examination to acquaint yourself with the instructions below and to read the question paper.

Do not write anything until the invigilator informs you that you may start the examination. You will be given five minutes at the end of the examination to complete the front of any answer books used.

Sept 2002

DE 4602

THE UNIVERSITY OF READING

Preparatory Course

FURTHER MATHEMATICS WITH COMPUTING

Paper 2 (Computer Science)

Two hours

Answer ALL of Part A, ONE question from Part B and ONE question from Part C. You are recommended to spend one hour on the short answer questions in Part A.

Calculators are NOT permitted.

Examination number: EX

Seat Number

Part A [50 marks]

*Answer **all** of the following questions. Write your answers on this sheet*

1. What is the difference between the **const** and **var** operators in Pascal?
[2 marks]

2. What is the difference between the **if..then..else** and **if..then** constructs in Pascal?
[2 marks]

3. How does a **while** loop differ from a **repeat** loop?

[2 marks]

4. Write a fragment of Pascal code to call procedures `Stop`, `Wait` or `Go` according to the value of a character variable `Light`:

Light	Call
= R	Stop
= O	Wait
= G	Go

[4 marks]

5. Write a Pascal procedure with heading

Procedure AddTwenty(**x:real**; **var y:real**);

That takes a real number **x**, adds 20 to it and returns the result in a parameter **y**.

[2 marks]

6. Assuming that these declarations are in scope

type

Tdate = **record**

DayNo:1..31;

MonthNo:1..12;

Year:1900..2100;

end;

var StartDate:Tdate;

Write a fragment of Pascal code to set the appropriate fields of **StartDate** to 10/5/2002 (10 May 2002).

[2 marks]

7. Assuming that these declarations are in scope

```
const MaxReals = 10;  
type TArrReal = array[0..MaxReals] of Real;  
var Number : TArrReal;
```

Write a fragment of Pascal code to set all the elements of the array Number to 0.
[3 marks]

8. What is the value of

$\text{Trunc}(7/2 - 1/4) + \text{Sqr}(3) + 5 \text{ div } 3$

[3 marks]

9. Assume that these declarations are in scope

```
type TArrInt = array [0..20] of Integer;  
var Vector : TArrInt;
```

Write a fragment of Pascal code to calculate and display the sum of all the integer values stored in `Vector`. [5 marks]

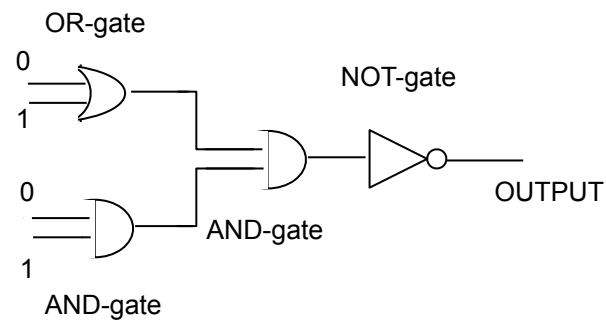
10. What will be the exact output of the following code?

```
for n:= 0 to 2 do  
  for m:= 1 to 2 do  
    if m<n then  
      Writeln('Hello');  
    else  
      Writeln('Goodbye');
```

[5 marks]

11. What is the value of OUTPUT in the logic circuit shown below?

[2 marks]



Answer: OUTPUT = _____

12. Name two examples of *web browsers*.

[2 marks]

13. What is the decimal equivalent of 1100011 (binary)?

[2 marks]

14. Specify one *special purpose register* and briefly describe its main function.
[2 marks]

15. What is the purpose of a *controller*?
[2 marks]

16. Name an input device (other than mouse or keyboard).
[1 mark]

17. State three methods of securing important computer data.

[3 marks]

18. What is the main purpose of the shell of an operating system?

[2 marks]

19. Describe any two differences between RAM (Random Access Memory) and ROM (Read Only Memory)?

[2 marks]

20. What is the difference between applications software and operating systems software?

[2 marks]

Part B [25 marks]

Answer *one* of the following questions on the blank paper or answer book provided.

21. Compare and contrast the use of an array with the use of several simple variables in Pascal. [5 marks]

Write a Pascal program that reads in a sentence (terminated by a full stop) and then displays the sentence in reverse without including the full stop. The program should then print another line underneath that states the total number of characters that were input (again excluding the full stop) and how many of these characters were spaces.

For example, if the program reads in the sentence:
This is a test.

It will display:
tset a si sihT
14 characters were input
3 were spaces

[20
marks]

22. Why should a programmer use procedures? [5 marks]

Write a Pascal procedure with header

procedure AverageTot
(Terminator:**real**; var Average, Total:**real**);

which reads an unknown number of reals. It should stop reading reals when the value of Terminator is found. The procedure should then calculate and return the average of the reals in the parameter Average and their total in Total. The value Terminator should not be included in the calculation of Average or Total.

For example, if the input is
3.0 -7 10.5 5.5 0
then after the code
AverageTot(0,Av,To)
has been executed, Av = 3.00 and To = 12.00

[20 marks]

Part C [25 marks]

Answer **one** of the following questions on the blank paper or answer book provided.

23. (a) What is meant by the term *Software Engineering*? [2 marks]
 (b) Describe four of the main stages in the software lifecycle. [8 marks]
 (c) What is a relational database? [2 marks]
 (d) Explain the following database terms:
 (i) field
 (ii) record
 (iii) primary key [3 marks]
 (e) Given the relations A and B as shown below, obtain the relations REL1, REL2, REL3, REL4 and REL5 described by the following instructions:

- (i) $REL1 \leftarrow PROJECT\ G\ from\ B$
 (ii) $REL2 \leftarrow SELECT\ from\ A\ where\ Z = 4$
 (iii) $REL3 \leftarrow PROJECT\ Y\ from\ REL2$
 (iv) $REL4 \leftarrow JOIN\ A\ and\ B\ where\ A.X > B.F$
 (v) $REL5 \leftarrow SELECT\ from\ B\ where\ F < 3$

A relation

X	Y	Z
3	K	4
7	J	4
2	D	1

B relation

F	G	
	5	R
	2	W

[10 marks]

24. (a) What is a process? How does this differ from a program? [3 marks]
 (b) Describe how CPU time can be shared between two processes. [6 marks]
 (c) Convert the following decimal numbers to binary (using two's complement notation and bit patterns of length four):
 (i) 3.75
 (ii) -7 [6 marks]
 (d) Convert the following binary number to both decimal and hexadecimal:
 01001101 [4 marks]
 (e) Perform the following arithmetic operation in binary:
 1.5 + 6.5 [6 marks]

[End of Question Paper]