THE BRITISH COMPUTER SOCIETY

THE BCS PROFESSIONAL EXAMINATIONS
BCS Level 4 Certificate in IT

SOFTWARE DEVELOPMENT

16th October 2007, 2.30 p.m.-4.30 p.m.
Time: TWO hours

Both Section A and Section B carry 50% of the marks. You are advised to spend about 1 hour on Section A (30 minutes per question) and 1 hour on Section B (12 minutes per question).

*The marks given in brackets are **indicative** of the weight given to each part of the question.*

Calculators are **NOT** allowed in this examination.

SECTION A
Answer TWO questions out of FOUR. All questions carry equal marks.

1. a) A programmer is encouraged to write explanatory comments into a program. Explain why the comment below is not a good comment.

```
x=(b+a)/2;          // x assigned (b+a)/2
```

(5 marks)

b) Choose either version of the code below and then write comments appropriate for
i) line 1
ii) line 3
iii) line 4
iv) line 5
v) line 7
vi) line 9

(18 marks)

	Version 1	Version 2
1	int f(int p, q)	INTEGER FUNCTION f(p, q AS INTEGER);
2	{	BEGIN
3	int x, y;	INTEGER x, y;
4	y = 0;	y ← 0;
5	for(x=p; x<=q; x++)	FOR x FROM p STEP 1 TO q DO
6	{	BEGIN
7	y = y + v[x];	y ← y + v[x]
8	}	END;
9	return(y);	f ← y
10	}	ENDFUNC

c) Based on your answers to (b), decide on better names for the identifiers (the function name, its parameters and the variables). **(5 marks)**

d) A subprogram is independent if all the values it requires are provided inside it or come via parameters. State, with reasons, whether the function f is independent in this sense. **(2 marks)**

2. Consider either version of the recursive function **r** shown below.

a) Write down the textual output and the numerical result that you would expect from the function **r** following the call **r**(1); **(4 marks)**

b) Write down the textual output and the numerical result that you would expect from the function **r** following the call **r**(2); **(6 marks)**

c) Write down the textual output that you would expect from the function **r** following the call **r**(4); **(10 marks)**

d) What result is obtained by the call **r**(4) ? **(4 marks)**

e) The printing in this function has been put there by the programmer to help during testing. Why is it not good practice to have a function which both creates output and returns a result? **(6 marks)**

Version 1	Version 2

int function r(int p){
  int x;
  x = 1;
  printf("p on entry %d \n",p);
  if(p > 1)
  x = p * r(p – 1);
  printf("p on entry %d\n",p);
  return(x);
}
	INTEGER FUNCTION r(p as INTEGER)
	  INTEGER x
	  x ← 1
	  PRINT "p on exit" p
	  IF p GREATER THAN 1
	  THEN x ← p * r(p – 1)
	  PRINT "p on entry" p
	  RETURN x
	ENDFUNC

3. Each day an Examiner marks some questions from A[1], A[2], B[5],B[6], B[7], B[8] from this examination paper. He needs to input daily the number of questions marked that day for each of these questions and then calculate the number of A-questions marked, the number of B-questions marked and the total number of questions marked. The totals for A and B are written to a file and the table shown below is printed.

Table of results

Question number	A1	A2	B5	B6	B7	B8	Total-A	Total-B	Grand-total
Day 1 totals	12		9	5			12	14	26
Day 2 totals	4	2	50		16		18	80	98

Develop the Initial Algorithm given below to a stage where coding would be straightforward. At least TWO stages must be shown.

Initial Algorithm
Open **questions marked** file and **totals** file
Read in the number of questions marked that day for A1, A2, B5,…, B8
Append the number of questions marked to the **questions marked** file
Read previous totals from file (Total-A, Total-B)
Calculate the new Total-A
Calculate the new Total-B
Output the new totals to the **totals** file
Calculate the new Grand-total

(30 marks)

4. A bookshop enquiry system contains details of books held in a warehouse. Customers make enquiries about particular books. Each book has a record structure as shown below:

BOOK
- NAME
  - Title — 30 characters.
  - Author — 30 characters.
  - Publisher — 30 characters.
  - ISBN-Number — 10 digits.
  - Catalog-ref — 10 characters.
  - Hardback — True/False
- LOCATION
  - Row-number — 1 character, 1 digit.
  - Aisle-number — 1 character, 1 digit.
  - Shelf-number — 1 digit.
- DETAILS.
  - Price per copy — (decimal currency)
  - In-stock Indicator — (yes/no)
  - Number of copies available — (whole number)

a) Specify this record structure in an appropriate programming language. State clearly which language you are using. **(6 marks)**

b) Set up a file or table to hold up to a thousand such records. You MUST be quite clear about what type of file you are using. **(4 marks)**

c) Develop an algorithm or pseudocode for a series of enquiries for particular books. An enquiry may use any of the entries under 'NAME'. For those whose entries are found, the data stored under 'LOCATION' is to be printed. If it is not found print 'NOT AVAILABLE'. If the 'Hardback' value is true, print 'HARDBACK BOOK'. The price is then printed and the customer is asked if he/she wishes to purchase it. If the answer is 'YES' the file is updated and the in-stock indicator adjusted accordingly. After each enquiry the user is asked whether he/she wishes to terminate or continue with enquiries. Counts must be made of enquiries; when the last enquiry has been processed how many successful and unsuccessful enquiries are displayed.

Two stages of algorithmic development must be given in your answer

Initial Algorithm **(7 marks)**
Developed Algorithm **(13 marks)**

SECTION B

Answer FIVE questions out of eight. All questions carry equal marks.

5. a) Write a suitable structure/record to hold data on jobs set down for a group of technicians to perform. The data fields are as follows:

JOB-DESCRIPTION.

Date (format day.month.year)	10 characters	
Job number	6-digit integer	
Estimated cost	decimal currency	
Authorisation	yes/no	
Description	30 characters	**(3 marks)**

b) At the end of each working day a file named newjobs is created containing jobs which came in that day and any not cleared from previous days.
Write an algorithm or program which reads this file and prints out all the data for those jobs which are authorized or the date is more than 2 days old. Count how many such jobs are found and print out this total at the end of the report. **(9 marks)**

6. A fortune telling program has as input a birth date in the form ddmmyyyy (where dd = day digits, mm = month digits, yyyy = year digits.) All the digits of the birthday date are then added together to form a two-digit number, as shown in the example below. Finally, these two digits are added together to reveal the primary indicator, whereby the prospects and capabilities are revealed for the person having that birth date. The program output is the indicator in the form shown below:

Example calculation:
A birth date is 11 May 1989.
Input is 11051989 as the full birth date.
Sum of digits = 1 + 1 + 0 + 5 + 1 + 9 + 8 + 9 = 34
Primary indicator = 3 + 4 = 7
Output: the indicator used in fortune telling = 34/7

You may assume that a FUNCTION length( ), with suitable parameters, is available which returns the length of a string of decimal digits. **(12 marks)**

7. The function $Fn(x) = LN(1.0 + x + x^2)$ may be evaluated using the Maclaurin series:
$Fn(x) = x + ½ x^2 - 2/3 x^3 + 3/4x^4 – 4/5x^5 + \ldots$

a) Write down the next two terms in this series. **(2 marks)**

b) Show how to calculate each term in the series. **(4 marks)**

c) Write a program which evaluates Fn(x) from input values of x and N using the Maclaurin series where N indicates the number of terms to be used in the series. It prints this value and compares it with the value obtained using the system function for LN(x) in the function definition. Finally the difference between these two values is printed. Information: LN(x) is the logarithmic function using *e* as base. **(6 marks)**

8. You are a Manager in a small software house with 10 professional programmer/analysts. You have been invited to amend some numerical analysis software, which is written in FORTRAN. The amendments are necessary due to a regulatory change. The software consists of approximately 30 working programs but not all of the programs need changing. Documentation, in some detail, is available for the larger programs but none exists for the smaller programs beyond comments in the code. The software house does not currently possess expertise in FORTRAN and redevelopment of all of the software in C/C^{++} is not an option as some of the supplied programs are very large.

a) On what basis would you decide whether to undertake this work or not? Give reasons. **(6 marks)**

b) State what facilities are required to speed up development of these programs. **(3 marks)**

c) Draft a test plan to systematically develop the necessary software. **(3 marks)**

9. a) Name the stage of the traditional software development process in which an algorithm would be introduced and give your reasons? **(6 marks)**

b) Name the stages that precede and follow the stage mentioned in your answer to a) and by concentrating on the algorithm describe the links between the three stages. **(6 marks)**

10. a) What does the term Sequential Access mean? **(4 marks)**

b) Briefly describe a part of a computer system which can be used as a Sequential Access device. **(4 marks)**

c) Give brief details of a situation in which a Sequential file would ideally be used. **(4 marks)**

11. A web form is to be used to gather information from students applying to a university computing department to join a course. The information required is the name of the student, their gender, which of the subjects Mathematics, Physics, Computing they have studied at school and which degree course they want to study.

a) State which type of form element is appropriate for each piece of information giving a reason. **(8 marks)**

b) Sketch how the final form might look as displayed by a web browser. **(4 marks)**

12. a) There are many kinds of errors that can occur in a program. Describe the following kinds of errors:

i) Syntax error
ii) Type error (type check error)
iii) Overflow error **(6 marks)**

b) For each of the kinds of errors mentioned in a), give simple program extracts in a language of your choice that demonstrate the error. **(6 marks)**

**** END OF PAPER ****