THE BCS PROFESSIONAL EXAMINATION
Certificate

**SOFTWARE DEVELOPMENT**

19<sup>th</sup> April 2002, 10.00 a.m.-12.00 p.m.
Time: 2 hours

**SECTION A**

Answer TWO questions out of FOUR.  All question carry equal marks.

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

1. A western-style name is held in an array of characters called '**namestr**'; the full name is delimited by quotes thus:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|
| ' | P | A | U | L |   | J | O | H | N  |    | W  | O  | O  | D  | S  | '  |

Forenames / Last name

The name is required to be output in the following format:

<Last name in full>, < Initial of first forename >.  < Initial of second forename >.  <…...>.

For example, the name

'PAUL JOHN WOODS'

is required to be printed as

WOODS,P.J.

Develop an algorithm for this process and show adequate development so that subsequent coding is straightforward.  State your target language.

The data has already been validated so you are NOT to deal with error situations: thus there will always be *at least* one forename, the space character will be present between the names and the array is big enough to hold all the characters.  **(30 marks)**

2. a) Describe a *Software Development Kit  (SDK) or* a *Software Development Environment (SDE)* with which you are familiar.  Be sure to explain the purpose of the software that the kit or environment is to produce.
   **(12 marks)**

   b) What generic elements or features should be present in a good SDK or SDE, and why?  Be sure to link your answer to types of software development practice that you know about**.**  **(8 marks)**

   c) What do you think is driving the changes in software development practice?  How will these changes be reflected in new SDK or SDE products?  Make your reasons plain.  **(10 marks)**

**[Turn over**

**3.** A key and a data item are stored in pairs in the following array

integer array **dataset**(1:2;1:n)

such that any one pair in **dataset** might look like **dataset**(key-x, value-x). value-x is never zero so it can be used as a test value.

A search algorithm is proposed as follows:

integer function **Afind** (input integer: dataval, range);
begin

comment **dataset** is a global two-dimensional array 1:2 by 1:range
comment This algorithm determines whether 'dataval' value is in **dataset**.
comment 'range' is the number of pairs in **dataset**.
comment If 'dataval' is found, the return value of **Afind** gives the associated key
comment If 'dataval' is not found, the return value of **Afind** is zero

local integer  key, pos;

key := 0;
pos := 0;
while key = 0 and range > pos do
begin
    pos := pos + 1;
    if dataval = **dataset**(2,pos) then key := **dataset**(1,pos)
end;

**Afind** := key;

end function  **Afind**;

*a)*    Given the following table of keys and values representing **dataset**:

| 12 | 4536 |
|----|------|
| 17 | 8723 |
| 9  | 1625 |
| 16 | 9165 |
| 14 | 1948 |
| 18 | 1984 |
| 10 | 7125 |
| 11 | 2638 |
| 8  | 5128 |
| 15 | 2584 |

Dry-run the execution of **Afind** (9165, 10). What is the value returned by **Afind**?    **(15 marks)**

*b)*    Describe the expected performance of the algorithm, making plain any assumptions you need to make.
    **(5 marks)**

*c)*    What features of the data might significantly change your estimate of performance?    (**10 marks**)

**4**. A PC-based stock enquiry system is to be used in a works chemical store to facilitate enquiries for specific chemicals and to expedite stocktaking. Each chemical has a record structure, part of which is shown below:

```
CHEMICAL.
        NAMES.
                Chemical-name.          30 characters.
                Industrial-name.        30 characters.
                Short-name.             10 characters.
                Catalog-ref.            10 characters.
        LOCATION.
                Row-number.             1 character and 1 digit.
                Aisle-number.           1 character and 1 digit.
                Shelf-number.           1 digit.
        HAZARDS.
                Hazard-Number.          1 digit.
                Classification.         10 characters.
                Poison-Rating.          10 characters.
```

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

*b)* Specify a file or table to hold up to 1,000 such records. **(4 marks)**

*c)* Write pseudo-code to handle a series of enquiries for different chemicals. An enquiry may use any of the entries under 'NAMES'. For those whose entries are found, the data stored under 'LOCATION' is to be printed. If an entry is not found, 'NOT AVAILABLE' is to be printed. If the 'Hazard-Number' is greater than 3, 'CHARTERED CHEMISTS ONLY' is also to be printed. If the entry in 'Poison-Rating' is 'SEVERE', 'RESTRICTED ACCESS' is also to be printed.

After each enquiry the user is asked whether he/she wishes to terminate or continue with another enquiry. When the last enquiry has been processed, the number of successful and unsuccessful enquiries is to be displayed. **(20 marks)**

## SECTION B

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

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

**5.** Using an appropriate programming language:

*a)* Define a data structure for one element of a linked list to contain a string of 3 characters as its data item. **(2 marks)**

*b)* Write code to read in and create a *linked list* of these elements where each new member is added to the head of the list. Input is terminated by '***'. **(6 marks)**

*c)* Write a function/procedure named 'length' which counts how many elements are present in the list.

State the programming language you have used. **(4 marks)**

**6.** Write a function 'pwr (p, n)' which returns the integer value of 'p' raised to the integer power 'n'.

   *a)*  using recursion **(6 marks)**
   *b)*  using iteration **(6 marks)**

**7.** Develop an algorithm for a function 'gentemp' which converts temperatures between the two commonly used scales, Celsius and Fahrenheit. The function has two parameters: 'namescale', being 'C' when 'Celsius' is the input temperature, or 'F' when a 'Fahrenheit' temperature is input. Any other entry is an error condition. The second parameter is the temperature (real number) which is to be converted. Use the relationship below to inter-convert the temperatures. **(12 marks)**

$$\frac{F - 32}{C} = \frac{9}{5}$$

**8**. *a)*  For each of the following file organisations, outline two business applications for which the file organisation is suitable.

   *i)*  Sequential file organisation **(3 marks)**
   *ii)*  Random file organisation **(3 marks)**

   *b)*  Sketch the index structure for each of these file organisations and describe how insertions, deletions and updates are implemented by this indexing structure. **(6 marks)**

**9.** *a)*  Web pages often offer a 'frames' and a 'no frames' option. Explain what these terms mean, and why they are important. **(4 marks)**

   *b)*  Sketch the graphical user interface (GUI) for a 'frames' web presentation, and give reasons for <u>two</u> of the GUI features you have included. **(8 marks)**

**10.** You have been asked *to test* an interactive web site that has been already implemented. The web site can capture clients' names and email addresses (when they complete answer-back forms) as well as offering to known clients facilities such as downloads of specialist advice relevant to your employer's main business area.

Briefly describe FOUR issues relevant to this kind of web presentation where the testing must be planned and completed satisfactorily before going 'live'. **(12 marks)**

**11.** Describe, with diagrams, the operation of a look-up table and identify an application that is particularly suited to this form of search and retrieval. Give reasons for your choice. **(12 marks)**

**12**. Write brief notes on each of the following:

   *a)*  independent compilation **(4 marks)**
   *b)*  formal and semi-formal specification of algorithms **(4 marks)**
   *c)*  search engines **(4 marks)**