UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
FINAL EXAM
SEMESTER I
SESI 2010/2011

NAMA MATA PELAJARAN	:	PENGATURCARAAN KOMPUTER
COURSE NAME	:	*COMPUTER PROGRAMMING*
KOD MATA PELAJARAN *COURSE CODE*	:	BDU 10103
KURSUS	:	1 BDT
TARIKH PEPERIKSAAN	:	NOV/DIS 2010
EXAM DATE	:	*NOV / DEC 2010*
JANGKA MASA	:	3 JAM
DURATION	:	*3 HOURS*
ARAHAN / *INSTRUCTION*	:	JAWAB SEMUA SOALAN DALAM BAHAGIAN A DAN SATU (1) SOALAN DALAM BAHAGIAN B. *ANSWER ALL QUESTIONS IN PART A AND ONE (1) QUESTION IN PART B.*

THIS QUESTIONS PAPER CONTAINS SEVEN (7) PAGES

PART A : Answer all three questions.

S1 Write in the form of FORTRAN expression for the following mathematical equations as given belows :

a. $y = \sqrt{(x-1)^3} + \frac{2}{5}x$

(3 marks)

b. $y = \dfrac{2x^2 + 4x + 1}{|x - 1|}$

(3 marks)

c. $y = 3\sin^2 x + 4\cos x^3 + \tan(2x)$

(3 marks)

d. $y = \ln(2x^2 + 4x + 1) + x^2$

(3 marks)

e. $y = \arcsin(3x) + \cos ec(1/2x) + \arctan(1/x)$

(3 marks)

f. $$y = \begin{cases} x^2 + 4x + 3 & -3 \le x < 1 \\ \log_{10}(x+1) & 1 \le x < 4 \\ \dfrac{1}{\sqrt{x^3 + 1}} & 4 \le x \le 10 \end{cases}$$

(5 marks)

S2 Given an array data stored in the file called as YDATA.Dat. Here one has to develop computer code, which allows obtaining the maximum and minimum value of that array of data. Beside that the computer code will also produce simultaneously the position of where the data reaches the maximum and minimum value. Sketch the flow chart and write the computer code.
The data arrangement stored in file YDATA.Dat is in the form as shown in Table S2:

Table S2

```
31
********************
No          Y
********************
1           3.242
2           4.571
3           2.111
4           5.981
5           8.711
6           12.141
..          ......
...         ......
...         ......

28          16.712
29          1.2225
30          6.4213
31          6.7118
```

The features of computer code should be able to :

(i) Read data file : YDATA.Dat automatically when it runs.
(ii) Produce the output on screen of monitor in the form :
- 5 blank : Maximum Value = - - - - - . - - - at data number : --- th.
- 5 blank : Minimum Value = - - - - - . - - - at data number : --- th.

(20 marks)

S3. Sketch the flow chart and write a computer code based on the following information. Given two matrices 4 x 4 [A] and [B]. These two matrices are stored in file Matrix_A.dat and Matrix_B.dat respectively. The coefficient of the Matrix A stored in the file Matrix_A.dat is given as follows:

```
4  4
*****************************
Coefficient Matrix A
*****************************
16.0    21.45    25.16    40.11
12.51   11.14    12.17    61.71
32.11   24.11    91.06    48.72
61.52   23.18    81.71    5.41
```

While for the Matrix B stored in file Matrix_B.dat is :

```
4  4
*****************************
Coefficient Matrix B
*****************************
76.02   51.42    15.11    50.16
22.51   81.12    22.11    21.74
42.11   64.15    71.05    58.73
11.52   13.19    41.74    15.47
```

Computer code will be developed to compute matrix [C] and [D] where these two matrices represent the summation and multiplication of matrix [A] and [B] respectively, as follows :

$$[C]=[B]-[A]$$
$$[D]=[A]\times[B]$$

The features of the developed computer code should be able to

(i) Read those two data file automatically when it runs..
(ii) Store the result of matrix [C] and [D] in a file with user key-in name of its file.
(iii) Show the result in the form given below

```
5 blank : Matrix summation result : Matrix [C]
5 blank : * * * * * * * * * * * * * * * * * * * * *
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  * * * * * * * * * * * * * * * * * * * * *
2 space blank
5 blank : Matrix multiplication result : Matrix [D]
5 blank : * * * * * * * * * * * * * * * * * * * * * * * * *
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  ----.--   ----.--   ---- . --   ---- . ---
5 blank  * * * * * * * * * * * * * * * * * * * * * * * * *
```

(20 marks)

Part B : Answer one question only

S4 If one has to carry out interpolation over an array of data set, he may use Lagrange interpolation method by using the following formula:

$$y(x) = y_1 + \frac{x - x_1}{x_2 - x_1}(y_2 - y_1) \quad \text{for } x_1 < x < x_2$$

$$y(x) = y_{N-1} + \frac{x - x_{N-1}}{x_N - x_{N-1}}(y_N - y_{N-1}) \quad \text{for } x_{N-1} < x < x_N$$

$$y(x) = \frac{(x - x_i)(x - x_{i+1})}{(x_i - x_{i-1})(x_{i+1} - x_{i-1})} y_{i-1} + \frac{(x - x_{i-1})(x - x_{i+1})}{(x_{i-1} - x_i)(x_{i+1} - x)} y_i$$

$$+ \frac{(x - x_{i-1})(x - x_i)}{(x_{i-1} - x_{i+1})(x_i - x_{i+1})} y_{i+1} \quad \text{for } x_{i-1} < x < x_i$$

Suppose in file XYDATA.dat, he has a data array which consists of 41 pairs of $(X, Y_1(X))$ and $(X, Y_2(X))$ as given in the Table S4.

Table S4 : DATA X,Y1 and Y2

41
****

XDT	YDT1	YDT2
0.0	3.2421	1.2423
0.25	1.2571	2.1111
0.50	2.4671	6.7184
0.75	1.4271	8.7185
1.00	5.7672	9.7174
1.25	8.4674	11.7189
1.50	1.4691	12.6185
- - -	- - - - -	- - - - -
- - -	- - - - -	- - - - -
5.00	11.4271	28.3187
5.25	15.7672	39.2174
5.50	18.4674	21.4189
5.75	21.4691	18.5186
- - -	- - - - -	- - - - -
- - -	- - - - -	- - - - -
9.00	41.4271	38.3127
9.25	31.4271	28.2287
9.50	25.7672	29.2571
9.75	18.4674	24.4189
10.00	11.4691	12.5187

Sketch the flow chart and write a computer code. The developed computer code should have the following features.

(i) Read data file automatically when it runs.
(ii) User has to key-in any value of X
(iii) Call SUBROUTINE INTERPOL twice, first as
CALL INTERPOL (XDT, YDT1, NP, X, Y1) and then
CALL INTERPOL (XDT, YDT2, NP, X, Y2)
(iv) The result will be displayed on the computer screen in the form of :
5 blank : At given x = -------.---
5 blank : Interpolated value for data YDT1 ➔ Y1 = -------.---
5 blank : Interpolated value for data YDT2 ➔ Y2 = -------.---

(40 marks)

S5 The airfoil coordinate of four digits NACA series for the upper $Y_U(x)$ and the lower surface $Y_L(x)$ can be written as :

$$Y_U(x) = Y_c(x) + Y_t(x)$$

and

$$Y_L(x) = Y_c(x) - Y_t(x)$$

where $Y_c(x)$ and $Y_t(x)$ represent the camber and thickness distribution of the airfoil along the chord line respectively. For a given maximum camber $y_{c\max}$, its position $x_{yc\max}$, and the maximum thickness $y_{t\max}$, the distribution of $Y_t(x)$ is given as:

$$Y_t(x) = 5y_{t\max}\left[0.2969\sqrt{x} - 0.126x - 0.3516x^2 + 0.2843x^3 - 0.1015x^4\right]$$

for $0 \le x \le 1$

While the camber distribution $Y_c(x)$ is given as:

$$Y_c(x) = \frac{y_{c\max}}{(x_{yc\max})^2}\left[\frac{y_{c\max}}{(x_{yc\max})^2}x - x^2\right] \quad \text{for } 0 \le x \le x_{yc\max}$$

and

$$Y_c(x) = \frac{y_{c\max}}{(1 - x_{yc\max})^2}\left[(1 - 2x_{yc\max}) + 2x_{yc\max}x - x^2\right] \quad \text{for } x_{yc\max} < x \le 1$$

The four digit NACA series airfoil is denoted as PQRS where:

the first digit P represents the maximum camber $y_{c\max} = \dfrac{P}{100}$,

the second digit Q represents the position of maximum camber $x_{yc\max} = \dfrac{Q}{10}$ and

the last two digits represent the maximum of airfoil thickness $y_{t\max} = \dfrac{RS}{100}$

Sketch the flow chart and write a computer code for generating airfoil coordinates having the following features:

(i) Able to generate any type of airfoil belong to the class of four digit NACA series by just entering the code series number arbitrary, for instance 2418, or 3424, etc
(ii) the number of points along the airfoil surface is user defined
(iii) the camber ordinate is written in the form of a subroutine
(iv) the thickness ordinate is also written in the form of a subroutine
(v) user has to key-in a file name for storing the airfoil coordinates
(vi) the stored result has to be in the following format:

```
5 blank : Airfoil Name : NACA - - - -
5 blank : Geometry Data Airfoil
5 blank : ************************************************
5 blank :  No    X       YC        YT        YU        YL
5 blank : ************************************************
           ---  ----.---  ----.---  ----.---  ----.---  ----.---
```

(40 marks)