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UNIVERSITI SAINS MALAYSIA

Second Semester Examination  
Academic Session 2007/2008

April 2008

**MSG 383 – Data Structures for Computer Graphics**  
**[Struktur Data untuk Grafik Komputer]**

Duration : 3 hours  
[Masa : 3 jam]

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Please check that this examination paper consists of NINE pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEMBILAN muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

**Instructions:** Answer **all four** [4] questions.

**Arahan:** Jawab **semua empat** [4] soalan.]

3. (a) Refer to Figure 3.1 given below. Obtain the binary tree traversals in
- (i) Preorder
  - (ii) Inorder
  - (iii) Postorder.

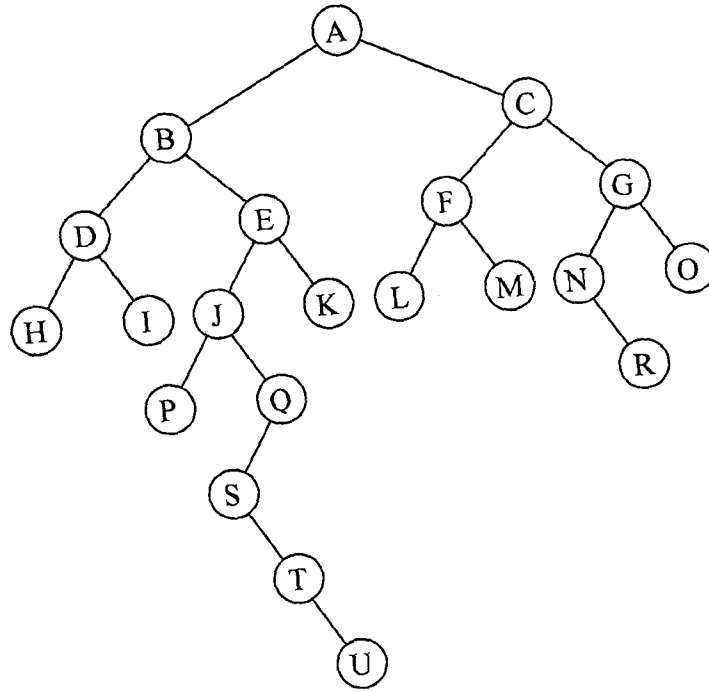


Figure 3.1

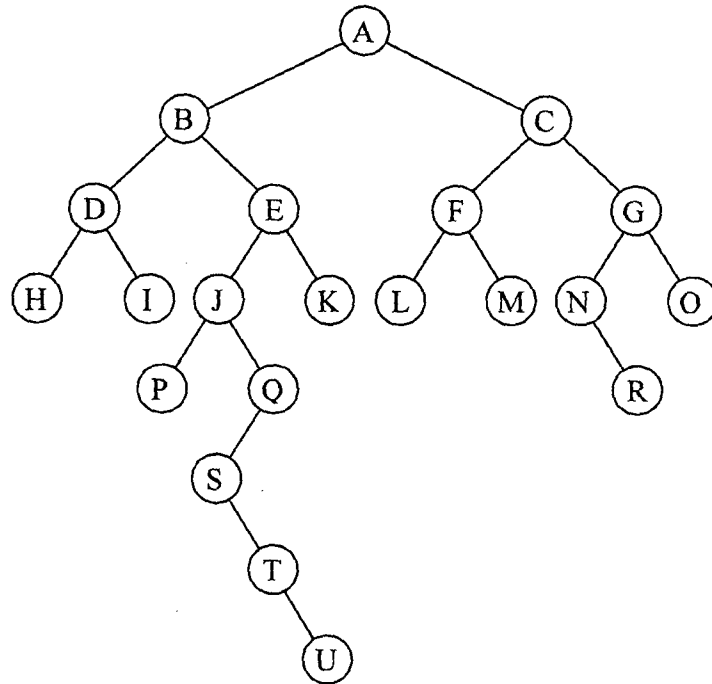
- (b) Given a data file which contains the letters as below:

```

AAABBBAACCCCAADD
EEEEDDDDDDDBBBBB
BBBBBDDDDDEEEEE
EDDDEEEEEDDDDDDDD
DDDD
    
```

- (i) Use the Huffman coding to build a Huffman's tree.
- (ii) Construct the Huffman codes for each letter that existed in the file.

3. (a) Rujuk kepada Gambarajah 3.1 di bawah. Dapatkan penyusunan pepohon perduaan dalam
- Tertib awalan
  - Tertib sisipan
  - Tertib akhiran.



Gambarajah 3.1

- (b) Diberi suatu fail data yang mengandungi huruf-huruf seperti berikut:

```

AAABBBAAACCCCAADDD
EEEEDDDDDDDDBBBBB
BBBBBDDDDDEEEEEE
EDDDEEEEDDDDDDD
DDDD
  
```

- Gunakan pengkodan Huffman untuk membina satu pepohon Huffman.
- Dapatkan kod-kod Huffman untuk setiap huruf yang wujud di dalam fail data.

3. (c) Figure 3.2 shows a picture that is divided into four quadrants in the order shown in Figure 3.3. Use the following notations

F : Full quadrant

P : Partially full quadrant

E : Empty quadrant

to picture a Quadtree of depth 3 for Figure 3.2. Label the branches and the nodes clearly.

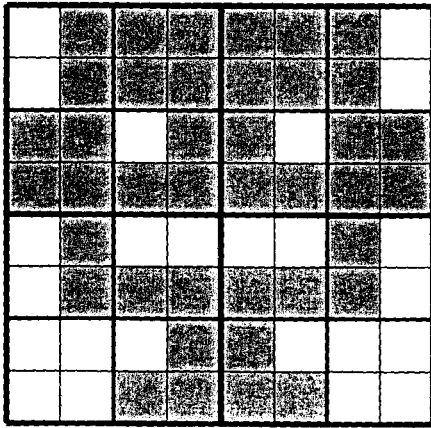


Figure 3.2

3	2
0	1

Figure 3.3

[100 marks]

4. (a) Write a non-recursive C++ function for the Bernstein polynomial

$$B_i^n(t) = \frac{n!}{i!(n-i)!} t^i (1-t)^{n-i}$$

where  $t \in [0, 1]$ ,  $n \geq 0$  and  $i = 0, 1, \dots, n$ .

- (b) Write a recursive C++ function for the Bernstein polynomial

$$B_i^n(t) = (1-t)B_i^{n-1}(t) + tB_{i-1}^{n-1}(t), \quad \text{if } n > 0,$$

$$\text{and } B_i^0(t) = \begin{cases} 1 & \text{if } i = 0 \\ 0 & \text{if } i \neq 0. \end{cases}$$

[100 marks]

...9/-

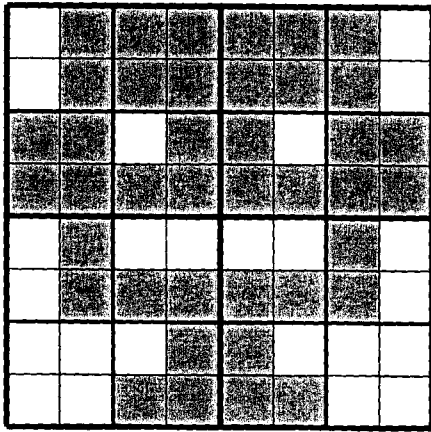
3. (c) Gambarajah 3.2 memaparkan satu gambar yang dibahagi kepada empat sukuan dalam tertib yang ditunjukkan dalam Gambarajah 3.3. Gunakan tatatanda berikut

$F$  : Sukuan penuh

$P$  : Sukuan penuh separa

$E$  : Sukuan kosong

untuk memapar satu pepohon Kuad yang mempunyai kedalaman 3 bagi Gambarajah 3.2. Tandakan setiap laluan dan nodnya.



Gambarajah 3.2

3	2
0	1

Gambarajah 3.3

[100 markah]

4. (a) Tuliskan satu fungsi C++ bercorak tak rekursi untuk polinomial Bernstein

$$B_i^n(t) = \frac{n!}{i!(n-i)!} t^i (1-t)^{n-i}$$

dimana  $t \in [0, 1]$ ,  $n \geq 0$  dan  $i = 0, 1, \dots, n$ .

- (b) Tuliskan satu fungsi C++ bercorak rekursi untuk polinomial Bernstein

$$B_i^n(t) = (1-t)B_i^{n-1}(t) + tB_{i-1}^{n-1}(t), \quad \text{jika } n > 0,$$

$$\text{dan } B_i^0(t) = \begin{cases} 1 & \text{jika } i = 0 \\ 0 & \text{jika } i \neq 0. \end{cases}$$

[100 markah]