Fundamental of Computer Science

Homework Set 7

December 6, 2023

1. (2') Suppose the letters are inserted in / removed from an empty queue in the following order: A, B, C, remove, D, remove, remove, E, F, remove, G.

Please fill the uppercase letters in the blanks (e.g., "CFG" without quotes).

a) List the letters remain in the **queue** from head to tail: EFG

b) If the letters are pushed onto / popped from an empty **stack**, List the remaining letters from bottom to top: AEG

2. (1') Suppose a tree has four nodes A, B, C, and D. If A and C are siblings and B's parent is A, which nodes are leaf nodes? Which node is the root?

Please fill the uppercase letters in ascending order (e.g., "BD" without quotes).

Which nodes are leaf nodes?	D
Which node is the root?	BC

3. (1') Show how the array on the right would be arranged in main memory when stored in **row major** order.

5	3	7
4	2	8
1	6	9

Fill a 9-digit integer in the form to represent the memory layout (e.g., "14253896" without quotes).

Your Answer	537428169

4. (1') Give a formula for finding the entry in the ***i***-th row and ***j***-th column of a two-dimensional array if it is stored in **column major** order. The address of the cell containing the entry in the first row and first column is *x*. The number of rows in the array is *r* and the number of columns is *c*. (Note that the *x* address is 1-th row and 1-th column.)

Fill a calculable formula containing variables *x*, *r*, *c*, *i*, *j* in the table (e.g., "x/2+r*4-c+1-i*j" without quotes, no need to use all variables).

Your formula	x+r*(j-1)+i-1

5. (2')

a) Assume the address of the beginning of the ***1***st entry in a **contiguous** list is *x* and the size of each entry is 10 bytes. What is the address of the ***4***th entry in the list?

Fill a calculable formula containing variables *x* in the table (e.g., "x*2+1" without quotes).

Your formula	x+30

b) The memory below stored a **linked** list of six items. Assume the memory cells at address A4 stored the head pointer of a linked list. Each item in the linked list consists of two bytes, which are the 8-bit data (first byte) and the address of the subsequent item in the linked list (second byte). What is the address and data of the **4**th item in the linked list?

Address	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF	B0
Contents	AF	7F	A9	AD	AD	B1	AB	A4	00	47	A5	8F	A7

Fill a 2-digit hexadecimal numbers in each form (e.g., "3F" without quotes).

Address of **4**th item	A5
Data of **4**th item	7F

6. (3') Determine whether the following description is correct and fill 'True' or 'False' in the forms ("T/F", "Yes/No", "0/1" will be regarded as wrong answers).

a) In the Von Neumann architecture, the **pointer** is implemented by the circuit.

b) **Lists**, **stacks** and **queues** can be implemented by **arrays**.

c) The **queue** is a last-in first-out data structure, and the **stack** is a first-in first-out data structure.

a)	False
b)	True
c)	False