UNIVERSITY OF GHANA

FACULTY OF ENGINEERING SCIENCES
SECOND SEMESTER EXAMINATIONS: 2011/2012
LEVEL 200: BACHELOR OF SCIENCE IN ENGINEERING
CPEN 204: DATA STRUCTURES AND ALGORITHMS *[3Credits]*

TIME ALLOWED: 3 HOURS

INSTRUCTIONS:
Answer ***ALL*** questions [100 MARKS]

Q1. (a) The following figure is a list of five hospital patients and their room numbers.

i) Fill in values for NSTART and NLINK so that they form an alphabetical listing of the names. [2 marks]

ii) Fill in values for RSTART and RLINK so that they form an ordering of the room numbers. [5 marks]

The NSTART and RSTART are the left and right header pointers respectively.

NSTART RSTART

SN	NAME	ROOM	NLINK	RLINK
1	Brown	650		
2	Mahama	422		
3	Letso	704		
4	Lantey	462		
5	Gloria	632		

(b) The figure below uses 2D array to simulate linked-list (first column stores data part and second column stores next part) for list class. Based on the figure, answer the following question:

	node	data	next
	[0]	66	-1
	[1]	25	-1
	[2]	?	?
	[3]	33	8
	[4]	?	?
First --->	[5]	10	9
	[6]	7	3
	[7]	?	?
	[8]	21	0
	[9]	48	6

i) What is the data value of the first element in the list? [2 marks]

ii) What is the data value of the third element in the list? [2 marks]

iii) What is the data value of the last element in the list? [2 marks]

EXAMINER: APPAH BREMANG

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(c) Determine the Big $O(\ )$ notation for the following:

i) $30n^3(2n^5+200n)$ [2 marks]

ii) $(n^2+n^2)(10n^3+50n)$ [2 marks]

iii) $(m+n)(10n^3+50n)$ [2 marks]

Q2.(a) Use the bubble sort algorithm to sort following array:

b[36]=346,b[37]=254,b[38]=272,b[39]=327,b[40]=227,b[41]=295,b[42]=320.

Indicate the number of scans and compare the preceding elements with the succeeding elements by using the following definitions; [10 marks]

let q = a pointer which counts the number of scan.

K = a pointer which is used to compare the first element and second element and the subsequent ones.

(b) Design ***procedure/algorithm*** to implement question **Q2(a)** . [5 marks]

(c) Using binary search algorithm, search for element 327 from the sorted data in **Q2(a)**.[6 marks]

(d) Design ***procedure/algorithm*** to implement question **Q2(c)**. [5 marks]

(e) State the complexity of:

i. bubble sort algorithm [2 marks]

ii. binary search algorithm [2 marks]

Q3. (a) Consider the following queue of characters, where QUEUE is a circular array which is allocated SIX memory cells: [10 marks]

QUEUE = -, A, B, D, -, -.

Indicate front and rear pointers of the above queue and describe the queue as the following operations take place;

1. F is added to the queue.
2. Two letters are deleted.
3. K, L and M are added to the queue.
4. Two letters are deleted.
5. R is added to the queue.
6. Two letters are deleted.
7. S is added to the queue.
8. Two letters are deleted.
9. One letter is deleted.
10. One letter is deleted.

(b) Suppose the following STACK is allocated N = 6 memory cells and initially STACK is empty, or in other words TOP = 0. Find the outputs (*at steps 2 and 3*) of the following module: [8 marks]

1. Set A: = 4 and B: = 3
2. Call PUSH(STACK, A)
   Call PUSH(STACK, 5)
   Call PUSH(STACK,B+ 5)
   Call PUSH(STACK, A+2)