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Minor (Lab) Examination

Course Code: CS102
Max Marks: 60
Venue: 211, LT-I

Course Name: Data Structures Lab
Date: 22/02/2024
Time Allowed: 02 Hrs. (09:00 Hrs. – 11:00 Hrs.)

Note: (i) More than one option may be correct for the objective type questions.
(ii) In objective question, marks will be awarded only if there is a justification for the option(s).
(iii) Attempt all the questions.

1. Suppose a circular queue of capacity (n – 1) elements is implemented with an array of n elements. Assume that the insertion and deletion operation are carried out using REAR and FRONT as array index variables, respectively. Initially, REAR = FRONT = 0. The conditions to detect queue full and queue empty are: (2)

   (A) Full: (REAR+1) mod n == FRONT, empty: REAR == FRONT
   (B) Full: (REAR+1) mod n == FRONT, empty: (FRONT+1) mod n == REAR
   (C) Full: REAR == FRONT, empty: (REAR+1) mod n == FRONT
   (D) Full: (FRONT+1) mod n == REAR, empty: REAR == FRONT

2. A program P reads in 500 integers in the range [0..100] representing the scores of 500 students. It then prints the frequency of each score above 50. What would be the best way for P to store the frequencies? (2)

   (A) An array of 50 numbers
   (B) An array of 100 numbers
   (C) An array of 500 numbers
   (D) A dynamically allocated array of 550 numbers

3. Consider the following statements: (2)

   (i) First-in-first out types of computations are efficiently supported by STACKS.
   (ii) Implementing LISTS on linked lists is more efficient than implementing LISTS on an array for almost all the basic LIST operations.
   (iii) Implementing QUEUES on a circular array is more efficient than implementing QUEUES on a linear array with two indices.
   (iv) Last-in-first-out type of computations are efficiently supported by QUEUES.

   Which of the following is correct?

   (A) (ii) is true
   (B) (i) and (ii) are true
   (C) (iii) is true
   (D) (D) (ii) and (iv) are true

4. Let A be a square matrix of size n x n. Consider the following program. What is the expected output? (2)

```
C = 100
for i = 1 to n do
  for j = 1 to n do
  {
    Temp = A[i][j] + C
    A[i][j] = A[j][i]
    A[j][i] = Temp - C
  }
```

```
for i = 1 to n do
  for j = 1 to n do
    Output(A[i][j]);
```

(A) The matrix A itself
(B) Transpose of matrix A
(C) Adding 100 to the upper diagonal elements and subtracting 100 from diagonal elements of A
(D) None of the above

(2)

5. The minimum number of stacks needed to implement a queue is:
   (A) 3
   (B) 1
   (C) 2
   (D) 4

6. A three-dimensional array in 'C++' is declared as int A[x][y][z]. Consider that array elements are stored in row major order and indexing begins from 0. How can the address of an item at the location A[p][q][r] can be computed if w is the word length of an integer? (2)

7. The five items: A, B, C, D, and E are pushed in a stack, one after other starting from A. The stack is popped four items and each element is inserted in a queue. The two elements are deleted from the queue and pushed back on the stack. Now one item is popped from the stack. The popped item is: (2)
   (A) A
   (B) B
   (C) C
   (D) D

8. Which of the following is the type of priority Queue? (2)
   (A) Ascending Order Priority Queue
   (B) Descending order Priority Queue
   (C) Deque
   (D) Both A and B.

9. Stack A has the entries a, b, c (with a on top). Stack B is empty. An entry popped out of stack A can be printed immediately or pushed to stack B. An entry popped out of the stack B can only be printed. In this arrangement, which of the following permutations of a, b, c are not possible? (2)
   (A) b a c
   (B) b c a
   (C) c a b
   (D) a b c

10. What is the output of following C program. (2)

```
#include <stdio.h>
int f(int n)
{
  if(n <= 1)
    return 1;
  if(n%2 == 0)
    return f(n/2);
  return f(n/2) + f(n/2+1);
}

int main()
```

```
{
  printf(\"%d\", f(11));
  return 0;
}
```

11. Given a queue with a linked list implementation. the Rear pointer points to the rear node of the queue. and the front node of the queue points to the front node of the queue, Which of the following operations is impossible to do in O(1) time? (2)

(A) Delete the front item from the list.
(B) Delete the rear from the list.
(C) insert at the front of the list.
(D) None

12. Suppose you are given an implementation of a queue of integers. The operations that can be performed on the queue are: (2)

i. isEmpty (Q) — returns true if the queue is empty, false otherwise.
ii. delete (Q) — deletes the element at the front of the queue and returns its value.
iii. insert (Q, i) — inserts the integer i at the rear of the queue.
Consider the following C function:

```
void f (queue Q) {
int i ;
if (!isEmpty(Q)) {
  i = delete(Q);
  f(Q);
  insert(Q, i);
 }
}
```

What operation is performed by the above function f?

(A) Leaves the queue Q unchanged
(B) Reverses the order of the elements in the queue Q
(C) Deletes the element at the front of the queue Q and inserts it at the rear keeping the other elements in the same order
(D) Empties the queue Q

**** Best of ~~Luck~~ Hard Work ****