**Assignment 1 : Submission Date : 30 August [2] Marks**

**Solutions Should be Well Explained**

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**Submit and upload after 28 August on MS Team**

1. **Consider the following pseudo code. Assume that IntQueue is an integer queue. print() prints the value. Print the output and explain the working if n=6.**

**void fun(int n)**

**{**

**IntQueue q = new IntQueue(); q.enqueue(0);**

**q.enqueue(1);**

**for (int i = 0; i < n; i++)**

**{**

**int a = q.dequeue(); int b = q.dequeue(); q.enqueue(b); q.enqueue(a + b); print(a);**

**}**

**}**

1. **Following is C like pseudo code of a function that takes a Queue as an argument, and uses a stack S to do processing.**

**void fun(Queue \*Q)**

**{**

**Stack S; // Say it creates an empty stack S**

**// Run while Q is not empty while (!isEmpty(Q))**

**{**

**// deQueue an item from Q and push the dequeued item to S push(&S, deQueue(Q));**

**}**

**// Run while Stack S is not empty while (!isEmpty(&S))**

**{**

**// Pop an item from S and enqueue the poppped item to Q enQueue(Q, pop(&S));**

**}}**

1. **What is the minimum number of stacks needed to implement a queue?**
2. **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?**
3. **If the elements “A”, “B”, “C” and “D” are placed in a queue and are deleted one at a time, in what order will they be removed?**
4. **A normal queue, if implemented using an array of size MAX\_SIZE, .The condition for queue is full is?**
5. **What are the applications of Queue data structures ?**
6. **The following postfix expression with single digit operands is evaluated using a stack:**

**8 2 3 ^ / 2 3 \* + 5 1 \* -**

# **Note that ^ is the exponentiation operator. What are top two elements of the stack after the first \* is evaluated?**

1. **Let S be a stack of size n >= 1. Starting with the empty stack, suppose we push the first n natural numbers in sequence, and then perform n pop operations. Assume that Push and Pop operation take X seconds each, and Y seconds elapse between the end of one such stack operation and the start of the next operation. For m >= 1, define the stack-life of m as the time elapsed from the end of Push (m) to the start of the pop operation that removes m from S. What is the average stack-life of an element of this stack?**
2. **A single array A[1..MAXSIZE] is used to implement two stacks. The two stacks grow from opposite ends of the array. Variables top1 and top2 (topl< top 2) point to the location of the topmost element in each of the stacks. If the space is to be used efficiently, What is the condition for “stack full”?**
3. **Assume that the operators +, -, × are left associative and ^ is right associative. The order of precedence (from highest to lowest) is ^, x, +, -. What is the postfix expression corresponding to the infix expression a + b × c - d ^ e ^ f?**
4. **In linked representation, of stack the null pointer of the last node in the list signals for what?**
5. Compute the Postfix equivalent of the following Infix expression

(i) **3\* log(x+1) – a/2. (ii) X and Yor Not(A>B)**

# **Suppose a stack is to be implemented with a linked list instead of an array. What would be the effect on the time complexity of the push and pop operations of the stack implemented using linked list (Assuming stack is implemented efficiently)?**

1. **Write correct output for the following sequence of operations.**

**push(5 )**

**push(8 )**

**pop**

**push(2)**

**push(5)**

**pop**

**pop**

**pop**

**push(1)**

**pop**

1. **The seven elements A, B, C, D, E, F and G are pushed onto a stack in reverse order, i.e., starting from G. The stack is popped five times and each element is inserted into a queue.Two elements are deleted from the queue and pushed back onto the stack. Now, one element is popped from the stack. What is the popped item?**
2. **Which data structure is used in breadth first search of a graph to hold nodes?**
3. A function f defined on stacks of integers satisfies the following properties. f(∅) = 0 and f (push (S, i)) = max (f(S), 0) + i for all stacks S and integers i.

If a stack S contains the integers 2, -3, 2, -1, 2 in order from bottom to top, what is f(S)?

1. Suppose implementation supports an instruction REVERSE, which reverses the order of elements on the stack, in addition to the PUSH and POP instructions. Which one of the following statements is TRUE with respect to this modified stack?

**(A)** A queue cannot be implemented using this stack.  
**(B)** A queue can be implemented where ENQUEUE takes a single instruction and DEQUEUE takes a sequence of two instructions.

**(C)** A queue can be implemented where ENQUEUE takes a sequence of three instructions and DEQUEUE takes a single instruction.

**(D)** A queue can be implemented where both ENQUEUE and DEQUEUE take a single instruction each.

1. A program attempts to generate as many permutations as possible of the string, ‘abcd’ by pushing the characters a, b, c, d in the same order onto a stack, but it may pop off the top character at any time. Which one of the following strings CANNOT be generated using this program?  
   **(A)** abcd  
   **(B)** dcba  
   **(C)** cbad  
   **(D)** cabd
2. Consider the following C program:

#include

#define EOF -1

void push (int); /\* push the argument on the stack \*/

int pop (void); /\* pop the top of the stack \*/

void flagError ();

int main ()

{ int c, m, n, r;

while ((c = getchar ()) != EOF)

{ if (isdigit (c) )

push (c);

else if ((c == '+') || (c == '\*'))

{ m = pop ();

n = pop ();

r = (c == '+') ? n + m : n\*m;

push (r);

}

else if (c != ' ')

flagError ();

}

printf("% c", pop ());

}

What is the output of the program for the following input ?  
5 2 \* 3 3 2 + \* +