Computer Science I Back paper Exam
Dec 2016
Indian Statistical Institute

Part I Answer any 15 of the following - 2x15 = 30 marks

1. The standard header……………… is used to access the functions 'malloc' and 'calloc'
2. In a C program, ……….. is used as the format specifier to print a character.
3. Negative numbers are represented in binary form in ..…………… notation
4. In a C program, the declaration
    char *str = "Hello";
    makes str a ……………
5. To store the correct value of 11.0 / 4.0 in a variable, declare the variable as a …………. data type
6. Reversing a string is best done using the ………….. data structure.
7. A 2x2 matrix can be implemented in C using ………………… arrays.
8. Consider char x = 'a'; printf("%d", x) will print ………. value of 'a'.
9. There are two ways in which one can call a function, pass by ……….. and pass by …………
10. A function that calls itself is called a ………………… function.
11. If a pop() operation is done on a Stack with one element, the Stack becomes ……………
12. Consider the code
    union test
       {
           unsigned int x;
           unsigned char y;
           int z;
       };
    sizeof(test) on a computer with int size 8 would yield ……………..

13. int i = 10; printf ("%d ", - -i) will print ………..
14. A binary tree has at the most ……………… children
15. The two's complement of the number -3 is ………….
16. In an empty circular queue, the Front and Rear pointers are the …………..
17. The function fgets() can be used to ……………….. a file
18. Arithmetic expressions are converted to …………….. form before they are processed by computers.

Part II Answer the following as True or False - 2x5 = 10 marks

1. Consider the following code
    FILE *fp;

    fp = fopen("fileio.txt", "r");

fp is a file pointer that is opened in the 'read-only' mode.
2. A global variable is defined inside the main() function of a program
3. First-in-first-out is an example of a Queue data structure
4. Consider the code
   ```
   int x = 200, y = 8;
   int *ip = &x;
   printf("%d %f \n", *ip, *ip / y);
   ```
   The above will print 20
5. A linked list 'llist' with pointers llist->prev and llist->next is an example of a singly linked list.

Part III Answer the following - 4x5 = 20 marks

1. For example, converting the expression 2 + 3 to postfix form would yield 2 3 +. Using the same principle to convert the following expressions to postfix form.
   a. x * y
   b. x+y * u-v
2. Declare a struct for a node on a doubly linked list that holds an integer data value.
3. Declare a Union consisting of two variables of type int and char.
4. Declare a function pointer for a function that takes one char argument and returns an int value.
5. Consider the code
   ```
   int i =5, j=0;
   do {
       j+=1;
   } while (j < i)
   ```
   How many times will the for loop execute?

Part IV Answer any 4 of the following - 5x4 = 20 marks

1. Write a function to concatenate two strings
2. Write a recursive function to compute the gcd of two numbers
3. Write a function that bubble sorts an array of integers
4. Show in steps the process of inserting a value 75 into a MAX heap 110, 95, 85, 75, 65, 55, 25, 40, 16, 17, 35, 27.
5. Consider the following program:
   ```
   #include <stdio.h>
   int x = 100;
   void testscope()  {
           int i = 70;
           printf("function scope %d \nglobal scope %d \n", i, x);
   }
   int main(void) {
           // your code goes here
   ```

```
        int i = 10, x = 50;
        printf("main scope %d \nglobal scope %d \n", i, x);
        testscope();
        if (i) {
                int i = 50;
                printf("block scope %d \nglobal scope %d \n", i, x);
        }
        return 0;
}
```

Provide the output of the above program

Part V Answer any one: - 4x5 = 20 marks each
1. Declare a stack using an array or a linked list

Write functions that perform the following operations on the stack:
   a. creates the stack
   b. push a value on to the stack
   c. pop from the stack
   d. checks if the stack is empty
   e. peeks the top of the stack

2. Write a program that does the following:
   a. Declares a struct to represent a node in a linked list. Each node has an
         integer data item and pointers to the next and previous nodes.
   b. Write functions to create the linked list, create a node, add a node, delete a
         node and search the list.
   c. Write a driver program that creates the linked list, adds 4 nodes and
         searches for a value 10 and prints the list.

3. Write a program to that does the following:
   1. Declares two 2x3 matrices
   2. Defines functions that
      a. adds the matrices
      b. Transposes the matrices
      c. Prints the diagonal of the matrices