B.C.S.E 1st Year 2nd Semester Examination 2016
Introduction to Computer Programming

Time: **Three hours** Full Marks: **100**

All questions carry equal marks of 20 *but* Question# 1 & 4 are compulsory
All programs must be well commented
Many-part questions have equal division and must be answered in one place

1. There is a straight line with numbered positions from 0 to N. A walker starts at one of these positions and steps forward or backward one position at a time. The probability of a forward step is P and of a backward step, therefore, is 1 – P (for example, P = 1 / 4 means only a quarter of the steps are forward). A walk ends when position 0 or N is reached. Simulate such walks to determine how often each of these end positions is reached. This is a random walk problem.

2. a) Write a program for sorting a set of data by *address calculation sort*.
   b) Write a program to find the largest, smallest, mean and standard deviation of a set of numbers without using an array.

3. a) Write a program to display sin(x)/x for 0 <= x <= 4 * PI with horizontal x-axis.
   b) Write a program to sort a set of data by insertion sort with sentinel.

4. a) Study this program:

```
#include <stdio.h>
int main(void) {
    unsigned int i; unsigned int *j; unsigned int **k;
    i=3;
    printf("i = %u \n", i); printf("&i = %p \n", (void*)&i);
    printf("*(&i) = %u \n", *(&i));
    j=&i;
    printf("j = %p \n", (void*)j); printf("&j = %p \n", (void*)&j);
    printf("*j = %u \n", *j); printf("*(&j) = %p \n", (void*)*(&j));
    printf("&(*j) = %p \n", (void*)&(*j));
    k=&j;
    printf("k = %p \n", (void*)k); printf("&k = %p \n", (void*)&k);
    printf("*k = %p \n", (void*)*k); printf("*(&k) = %p \n", (void*)*(&k));
    printf("&(*k) = %p \n", (void*)&(*k)); printf("**k = %u \n",**k);
    return 0;
}
```

   Assuming addresses of i, j, k are x, y, z respectively, what are the outputs?
   b) Write a program to swap two integers using a function that allows parameter passing only by reference and does not use any 'temp' variable.

5. a) Write a program to implement the complex data type. This means create the appropriate data types and functions for all valid operations on complex numbers.
   b) Write a program to calculate and display the truth table of all the unique Boolean functions of two variables.

6. a) Write a program to input a date in the form ddmmyy and output as 'month date, year', for example, 221101 becomes November 22, 2001.
   b) Write a program for the sequence guessing game 1, 3, 6, 10, 15, 21, 28, 36, 45, 55,...

7. a) Write a program to find the 4^{th} root of a number but do justify the method.
   b) Write a program to find the value of sin(x) with 10^{-4} accuracy.