B.C.S.E 1ˢᵗ Year 2ⁿᵈ Semester Examination 2015
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. Write a main program that acquires a dynamic array of integers of some size, fills it with random integers in a given range, prints it, looks for a given integer in the array with linear search, sorts it with insertion sort and then again looks for a given integer with binary search; all using user-defined functions. Also, write all these functions integrated with the main grogram.

2. a) Write a program to find the sum of 1/n taken n times for values of n ranging from 1 to 100000 where n is a floating point number. Comment on the output.
    b) Write a program to display sin(x)/x for $0 <= x <= 4 * PI$ with horizontal x- axis.

3. a) Write a program to convert an Arabic numeral in the range 1 – 9999 to Roman numerals where N=5000, M=1000, D=500, C=100, L=50, X=10, V=5 and I=1.
    b) Write a program to convert a decimal number to its binary equivalent and back.

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 type and functions for all valid operations on complex numbers.
    b) Write a program to find all the prime factors of a number.

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