1. (15%) Consider the following popular programming languages: C, C++, Java, Ruby, Python, R.
   a. (5%) Which languages are usually executed via an interpreter without compiling?
   b. (5%) Which languages support object-oriented programming?
   c. (5%) Which languages can be developed under both Linux and Windows systems?
2. (5%) What is arithmetic overflow?
3. (5%) Which of the following C statements will generate a random number within the integer set of {10, 11, …, 14, 15}?
   a. (rand( ) % 15)+11;
   b. (rand( ) % 16)+10;
   c. (rand( ) % 5) + 11;
   d. (rand( ) % 6) + 10;
   e. None of the above statements.
4. (5%) Write down the output of the following C program

```
void swap(int a, int b) {
    int c = a;
    a = b;
    b = c;
}
int main()
{
    int a=1,b=2;
    swap(a, b);
    printf("%d %d", a, b);
    return 0;
}
```

5. (5%) Write down the output of the following C program

```
#include <stdio.h>
int x=1;
int func(int x){
  return x++;
}
int main(void){
  printf("%d\n", func(x));
  printf("%d\n", x);
  return 0;
}
```

6. (10%) Write down the output of the following C program

```
void main()
{
   int s[5]={5, 4, 3, 2, 1};
   int *p=s , *ptr=s+2 ;
   printf("A:%d\n", *p+2);
   printf("B:%d\n", *ptr);
   printf("C:%d\n", s[0]);
   printf("D:%d\n", *p++);
   printf("E:%d\n", *p);
}
```

7. (5%) Write down the output of the following C program

```
#define A  1
#define B  2
#define C  3
int hanoi(int N, int from, int to, int using)
{
   static int count=0;
   if (N > 0) {
      hanoi(N-1, from, using, to);
      count++;
      hanoi(N-1, using, to, from);
   }
   return count;
}
int main (void)
{
   printf("%d\n", hanoi(5, A, C, B));
   return 0;
```

8. (20%) Write a C code to perform y[n] = 0.5 x[n] + 0.3 x[n-1] + 0.2 x[n-2], where y and x are both 1-D arrays with 1000 double-precision floating-point elements and x[-2] = x[-1] = 0. What is the maximum difference between the computed y[n] and its real-valued result?
9. (20%) Redo Problem 8 if y[n] and x[n] are 16-bit integers (i.e. short).
10. (10%) Describe the function of the following circuit. Note that din and dout are logic signals, and clk is the clock signal switching between logic 0 and 1.