10%(I) Answer the following questions regarding the Software Engineering:
   a. What is the difference between system requirements and system specifications? (2%)
   b. Explain the concept of the Software Life Cycle. (2%)
   c. Summarize the distinction between top-down and bottom-up design strategies. (2%)
   d. Contrast the information represented in dataflow diagrams with that given in structure charts. (2%)
   e. What is black-box testing? What is glass-box testing? (2%)

10%(II) Briefly answer the following questions regarding the Software Engineering:
   a. Rational ROSE is one of the popular CASE tools. What is a CASE tool? (2%)
   b. What is an entity-relationship diagram? Explain it with an example. (2%)
   c. What is the difference between a class diagram and an entity-relationship diagram? (2%)
   d. What is a Design Pattern? (2%)
   e. What is Object-Oriented Technology? (2%)

10%(III) Briefly answer the following questions: (2% for each)
   a. What is HTTP? What is a WWW server?
   b. What is Client/Server Computing Model?
   c. What is 3-Tier or multi-Tier Computing Model?
   d. Explain virus, worm, and Trojan horse.
   e. What is CORBA? What is the OMG organization?

10%(IV) Briefly answer the following questions: (2% for each)
   a. Explain “Overflow” and “Underflow” for representing data in the computer.
   b. If an ECC (Error Correcting Code) can automatically correct the error when one bit of the data is error, what is the minimum Hamming distance of the code?
   c. What is the “Principle of Locality”? Explain how to use it in memory hierarchy design efficiently.
   d. Compare CISC and RISC computer architectures.
   e. What is von Neumann bottleneck?

10%(V) Consider the Data Base Management System:
   a. Design a Relational Database containing information about the student information, their basic data, and their scores in a university. Use at least two tables. (7%)
   b. Give a SQL statement to “Get the list of the students that score of ‘Introduction to Computer Science’ >=90 and his average score of all subjects < 80”. (3%)
10%(VI) Consider the following C/C++ programs:

5% (a) Give the output of the following C program:
```c
#include <stdio.h>

int c=0; /* global variable*/
int testaa() { int x = 0; c++ = x; return x++;
int testbb() { static int x = 0; c++ = x; return x++;
int main() {
  int a1=testaa(), a2=testaa(), a3=testaa();
  int b1=testbb(), b2=testbb(), b3=testbb();
  printf("a=%d \%d \%d\n", a1, a2, a3);
  printf("b=%d \%d \%d\n", b1, b2, b3);
  printf("c=%d\n", c); return 0;
}
```

5% (b) Give the output of the following C++ program:
```cpp
#include <stdio.h>

long K,L;
long P (long X) {
  long L = X+1; K = K+1;
  return L + (X++);
}
long Q (long& X) { /* Note that X is call by reference */
  long L = X+1; K = K+1;
  return L + (X++);
}
int main() { int ans; K = 1; L = 1;
  ans = P(K); printf("%3d %3d %3d\n", ans, K, L);
  ans = P(L); printf("%3d %3d %3d\n", ans, K, L);
  ans = Q(K); printf("%3d %3d %3d\n", ans, K, L);
  ans = Q(L); printf("%3d %3d %3d\n", ans, K, L);
}
```

10%(VII) Consider the Data structure abstraction. You can explain your algorithms using a C++ template class or a Java class as an example for each.

a. Describe how a STACK can be implemented as a linked list. Diagram the PUSH and POP operation for the linked-list implementation. (Draw the figures before and after the push/pop operations.) (5%)

b. Describe how a QUEUE can be implemented as a circular queue using array. Write all the necessary operations for a queue (enqueue, dequeue, empty, isfull). (5%)

10%(VIII) Consider the recursive algorithms.

a. Write a C/C++ function `long gcd(int m, int n);` to find the Greatest Common Divisor of m and n; where m, n are integers. (might be negative). (5%)

b. Explain the Fibonacci rabbit problem and write it's recursive function. (5%)

10%(IX) Consider the infix, prefix, and the postfix notation of an expression:

a. Describe a process to convert an infix expression into a postfix expression. (5%)

b. Express each of the following infix expression in postfix notation and prefix notation:
```
b-1. 38*49/7-50*66+72/8. (2%) b-2. 2*(3*4/(55-49)+88/22)-99 (3%)
```

10%(X) Consider the protocol stack used in computer network:

a. Describe the four layers of the TCP/IP protocol stack. (3%)

b. Explain the meaning of “TCP is a reliable and connection-oriented protocol.” (3%)

c. Describe the OSI 7-Layer Reference Model. Explain the function of each layer. (4%)