I. (25%) Answer the following questions.

1. (10%) Assume that an eight-bit floating-point format is represented as $f_0f_1f_2f_3f_4f_5f_6f_7$, where f_0 is the sign bit, $f_1f_2f_3$ is exponent (represented with the three-bit excess system), and $f_4f_5f_6f_7$ is mantissa.
   (a) What is the largest value that can be represented? Justify your answers.
   (b) What is the smallest positive value that can be represented? Justify your answers.

2. (5%) Explain that, in a time-sharing system, how high-priority processes can be allowed to run faster than other processes.

3. (10%) Mass storage, main memory, and general-purpose registers are all storage system. Explain the difference in their use.

II. (25%) Answer the following questions.

1. (12%) Define each of the following terms. (Please give the full name for each acronym.)
   a. TCP/IP
   b. DNS lookup
   c. HTML
   d. XML
   e. Proxy server
   f. DoS

2. (7%) The factorial of a positive integer n is defined as n! = n*(n-1)*…*2*1. Design two algorithms that compute the factorial of a given positive integer.
   a. (3%) Based on a loop structure
   b. (4%) Based on a recursive structure

3. (6%) Explain three of the most important characteristics of object-oriented programming languages.

III. (25%) Answer the following questions.

1. (10%) Answer the following Choice Questions:

(i). Which of the following is not represented in a class diagram?

A. Generalizations B. The methods within a class

C. The attributes within a class D. The number of instances each class will have

(ii) Which of the following is a means of controlling the complexity of a software system?

A. CRC cards B. Modularity C. Specifications D. Beta testing

(iii) Which of the following is not a tool for designing modular systems?

A. Structure charts B. Data dictionaries C. Class diagrams

D. Sequence diagrams

(iv) Which of the following appears to be the most functionally cohesive?

A. A module that handles all of a customers banking needs

B. A module that handles only transactions related to checking accounts

C. A module that only records deposits to checking accounts

D. A module that collects data for monthly statements

(v) If a class diagram indicates a one-to-one relationship between class X and class Y, then

A. there will be only one object in the system of "type" X.

B. each object of "type" X will be associated with only one object of "type" Y.

C. there will be exactly one object of "type" X and exactly one object of "type" Y.

D. an object of "type" Y cannot occur without first constructing an object of "type" X.

2. (10%) Suppose the abstract data type StackType was defined as follows:

```
define type StackType to be
{int StackEntries[20];
 int StackPointer = 0;
 procedure push(Value)
 {StackEntries[StackPointer] ← Value;
  StackPointer ← StackPointer + 1;
 }
}
```

(i). What would be the value of the variable StackPointer associated with Stack after executing the following statement?

StackType Stack;

(ii). Then, what would be the value of StackPointer associated with Stack after executing the following statement?

Stack.push(5);

3. (5%) Which of the operations SELECT, PROJECT, and JOIN are actually used when executing the following SQL instruction?

```
select A, B
   from X
   where C = D
```

IV. (25%) Answer the following questions.

1. (5%) Which of the following is used for cutting a portion of an image?
   (a) Anti-aliasing
   (b) Clipping
   (c) Scan conversion
   (d) Ray tracing

2. (5%) If an RSA public key encryption system were based on the primes $p = 3$ and $q = 7$, which of the following pairs of values would be suitable for the encryption and decryption keys e and d?
   (a) 2 and 6
   (b) 5 and 29
   (c) 4 and 9
   (d) 7 and 23

3. (5%) (a) List the prime factors of 66043.
   (5%) (b) Let f(m) be the number of x, $1 \leqq x \leqq m$, such that x and m are relatively prime, what is f(255)?

4. (5%) Explain the distinction between weak AI and strong AI.