1. Explain the following terms.(15%)
   (a) Thread
   (b) DBMS
   (c) Terabyte
   (d) Data dictionary
   (e) Data and Information

2. Consider the following codes for the producer and consumer processes. The *no-op* is a do-nothing instruction. The shared buffer is an array indexed from *0* to *n-1*.
   (a) How many items at most can be stored in the buffer at the same time?(5%)
   (b) If the number of items is less than *n*, modify the codes to provide a solution where *n* items can be stored in the buffer at the same time.(15%)

```
repeat
  ...
  produce an item in next_P
  ...
  while (in+1 mod n = out) do no-op;
  buffer[in]:=next_P;
  in:=in+1 mod n;
until false;
```

```
repeat
  while (in = out) do no-op;
  next_C:=buffer[out];
  out:=out+1 mod n;
  ...
  consume the item in next_C
  ...
until false;
```

3. Describe three network topologies, and discuss their advantages and disadvantages in detail. (20%)

4. According to the following description of the company's operations
   a. The company manages many projects;
   b. Each project requires the services of many employees;
   c. An employee may be assigned to several different projects;
   d. Some employees are not assigned to a project and perform duties not specifically related to a project. Some employees are part of a labor pool, to be shared by all project teams. For example, the company's executive secretary would not be assigned to any one particular project;
   e. Each employee has a (single) primary job classification. This job classification determines the hourly billing rate;
   f. Many employees can have the same job classification. For example, the company employs more than one electrical engineering;

   and your experiences about database design and system development, to
   (a) Create the corresponding complete E-R diagram; and to (10%)
   (b) Define all attributes then give final normalized relational schema. (10%)

5. For Fibonacci Number computation $F_i=F_{i-1}+F_{i-2}$, where $F_0=0$, $F_1=1$, $i>=2$, to
   (a) Give recursive and iterative algorithms; then to (10%)
   (b) Analyze the algorithms carefully to give their complexities. (15%)