1. Indicate whether each of the following statements is true or false and amend them for those false statements.
(10%)
   (a) The C language is a functional language that makes it ideal for writing low-level operating system functions.
   (b) The LISP language is an applicative language that maps programs uniformly onto list structures.
   (c) Ada is a general-purpose language that supports modularity with tasks and concurrent programming with packages.
   (d) PASCAL is a third-generation language that allows the passing of procedures as parameters.
   (e) SNOBOL 4 is a string manipulation language with a static binding between variables and their types.

2. Indicate whether each of the following statements is true or false and justify your answer with reasoning and supportive or counter examples:
(10%)
   (a) The CPU computations and I/O operations cannot be overlapped in a multiprogrammed computer.
   (b) Synchronization of all PEs (Processing elements) in an SIMD (Single instruction over multiple data streams) computer is done by hardware rather than by software as is often done in most MIMD(Multiple instructions over multiple data streams) computer.
   (c) As far as programmability is concerned, shared-memory multiprocessors offer simpler interprocessor communciation support than that offered by a message-passing multicomputer.
   (d) In an MIMD computer, all processors must execute the same instruction at the same time synchronously.
   (e) As far as scalability is concerned, multicomputers with distributed memory are more scalable than shared-memory multiprocessors.

3. What are the basic elements of a specification of a data type? (5%)

4. Discuss the advantages of a relational database system. (5%)

5. What are the main features of asynchronous and synchronous communications? (5%)

6. Discuss the advantages of well-balanced binary tree. (3%)

   What is an VAL-balanced tree? (2%)

   Draw a diagram to show the general "single rotation" transformation that is applied to a subtree rooted on a node that has become unbalanced due to adding a node to the left, and summaize the reasons why it works. (5%)

7. Is the straight selection sort is more efficient than the bubble sort? Please give your comments. (5%)

8. Explain the temporal locality, spatial locality, and sequential locality associated with program/data access in a memory hierarchy.(5%)

9. What is the fundamental property of a real-time program?(5%)

10. What is a bridge? (2%)

    What is a gateway? (2%)

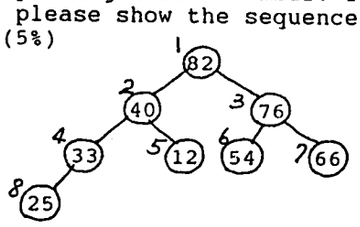
    If a Novell PC based network will be connected with an Ethernet network, which device(s)(bridge/gateway) can be selected to take the interconnection? (2%)

11. The basic mechanism of interprocess communication in the UNIX operating system are pipes, signals, and shared files. Please describe briefly how they are implemented. (9%)

12. Most of the fourth-generation languages support modularity by means of abstraction. What is an abstraction? What's the purpose? (5%)

13. Explain how instruction set, compiler technology, CPU implementation and control, and cache and memory hierarchy affect the CPU performance and justify the effects in terms of program length, clock rate, and effective CPI (cycles per instruction). (5%)

14. Heapsort is simply an implementation of the general selection sort using a heap representing a descending priority queue for the input data. The following shows a heap of size 8. The number outside the circle represents the corresponding node's number. If the node with 40 will be removed from the heap, please show the sequence of the node's number that will be visited? (5%)



15. Use a FULL ADDER (nothing else) to implement a circuit that will indicate the binary equivalent of $(x^2 + x + 1)$, where x=AB is a 2-bit binary number. Assume that the inputs and outputs are all ACTIVE HIGH. (10%)