1. (10 pts)
   a) In searching unordered lists, what do the Move-to-Front Heuristic and the Transpose Heuristic mean?
   b) What are the advantages and disadvantages of the above two strategies?
   c) Which one of the above two strategies is more suitable if the list is implemented as a table in contiguous memory? Explain why.

2. (20 pts)
   a) What is a binary search tree?
   b) Suppose the nodes in a binary search tree has the following structure.

   Write a function BinaryTreeLookUp( ) which will find the key K in tree P, by recursive search, and return its info. If there is no such record, return Λ. The first line of your algorithm should be:

   function BinaryTreeLookUp( key K, pointer P): info

   c) Write a non-recursive version of the function BinaryTreeLookUp( ) to perform the same function as that in b). Why can the function be written as a non-recursive algorithm?

3. (20 pts)
   a) What is the definition of the minimum spanning tree of a graph?
   b) Using the Prim’s algorithm, show the detailed steps of finding the minimum spanning tree of the following graph.
4. (8 pts) Consider a machine with a byte addressable main memory of 1M bytes and a block size of 16 bytes. Assume the cache is 32K bytes, answer the following questions:
   a. If the cache is a direct mapping cache, how is the address divided into fields to determine a cache hit/miss?
   b. If the cache is a 4-way set-associative mapping cache, how is the address divided into fields to determine a cache hit/miss?

5. (9 pts) Prove that the NOR gate is universal by showing how to build the AND, OR, and NOT functions using a two-input NOR gates.

6. (15 pts) Answer the following questions:
   a. Simplify the Boolean \(F(w, x, y, z) = \sum(1, 3, 7, 11, 15)\).
   b. Implement the simplified Boolean function using NAND gates.
   c. Implement the simplified Boolean function using a 16-to-1 multiplexer.

7. (12 pts) Write code to accomplish each of the following:
   a. Define a structure called part containing int variable partNumber and char array partName with values that may be as long as 25 characters (including the terminating null character).
   b. Define Part to be a synonym for the type struct part.
   c. Use Part to declare variable a to be of type struct part, array b [10] to be of type struct part and variable ptr to be of type pointer to struct part.
   d. Assign the member values of variable a to the third element of array b.
   e. Assign the address of array b to the pointer variable ptr.
   f. Print the member values of third element of array b using the variable ptr and the structure pointer operator to refer to the members.

8. (6 pts) Write for statements that print the following sequences of values:
   a. 20, 14, 8, 2, -4, -10
   b. 19, 27, 35, 43, 51