1. Give the contents of the hash table that results when the keys {H, A, P, P, Y, D, A, Y} are inserted in order into an initially empty table of size 10. $h_1(k) = k$ mod 10 for the kth letter of the alphabet. (20%)

   (a) Separate chaining.

   (b) Open addressing using linear probing.

   (c) Open addressing using quadratic probing.

   (d) Open addressing using double hashing, $h_2(k) = 7 - (k$ mod 7).

2. Give the contents of the B-tree that results when the keys {14, 54, 12, 65, 45, 87, 57, 43, 11, 24, 81, 10} are inserted in that order into an initially empty tree, with $M = 4$. (10%)
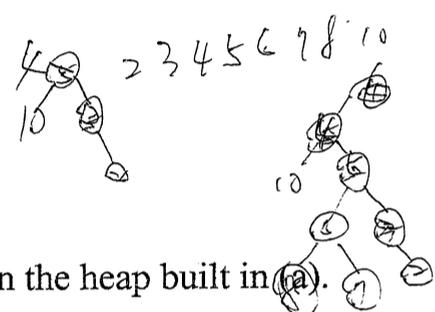
3. For the input {10, 5, 2, 4, 6, 8, 7, 3}. (30%)

   (a) Draw the construction process of a binary heap.

   (b) Show the result of performing three *deleteMin* operations in the heap.

   (c) Draw the sorting process in increasing order by *heapsort* performed on the heap built in (a).

4. Find the shortest path of the graph in Figure 1. (20%)

   (a) Apply *DIJKSTRA's* algorithm, starting at a.

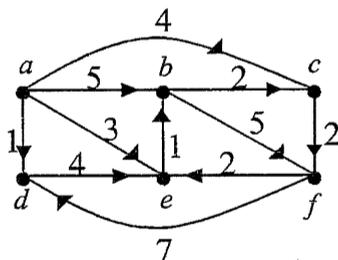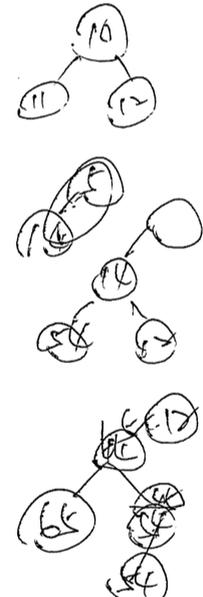   (b) Use *WALLSHALL's* algorithm to find all the shortest paths from each vertex.

Figure 1

5. Draw a Huffman coding tree for the string "ABRACADABRA". How many bits does the encoded message require? (10%)

6. Please write the correct order for the regular expression (a+b*c)*d*(a+(b+c)). (10%)

   (a) The prefix order.

   (b) The postfix order.