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Question 1:

a) DFS

Order of vertex visit: 1,2,3,4,5,6,8,7

Discovery edges in order of labeling: (1,2),(2,3),(3,4),(4,5),(5,6),(6,8),(5,7)

Back edges in order of labeling: (3,1),(5,3),(6,3),(8,4),(7,4)

b) BFS

Order of vertex visit:1,2,3,4,5,6,7,8

Lists Li: {1}, {2,3}, {4,5,6}, {7,8}

Discovery edges in order of labeling:(1,2),(1,3),(3,4),(3,5),(3,6),(4,7),(4,8)

Cv 5ross edges in order of labeling: (2,3),( 4,5),(5,6),(5,7),(6,8)

Question 2: Dijkstra

a)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| New Vertex | A | B | C | D | E | F | New Edge |
| A | 0 | 5 | ∞ | 10 | ∞ | 4\* | --- |
| F | // | 5 | ∞ | 9 | ∞ | 4 | (AF) |
| B | // | 5\* | 7 | 8 | ∞ | // | (AB) |
| C | // | // | 7\* | 8 | 9 | // | (BC) |
| D | // | // | // | 8\* | 9 | // | (BD) |
| E | // | // | // | // | 9\* | // | (CE) |

b) weight of shortest path spanning tree = AF+AB+BC+BD+CE

= 4+5+2+3+2=16

Question 3:

a) Prim-Jarnik algorithm: {AF, AB, BC, CE, ED}

Edges in order they are added to MST (direction important):

Total weight of the MST=14

b) Kruskal’s algorithm

Edges in order they are added to MST: {DE, CE, BC, AF, DF}

Total weight of the MST=14

Question 4:

a) chaining:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  | 13 | 3 | 15 | 5 |  |  |  |  |  |
|  |  |  | 25 | 4 | 16 |  |  |  |  |  |

Number of probes to find each key: 5:1, 3:1, 15:1, 25:2, 4:2, 13:1, 16:2

Average number of probes to find a key: (1+1+1+2+2+1+2)/7= 1.43

b) quadratic probing:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|  |  | 13 | 3 | 15 | 5 | 16 | 25 | 4 |  |  |

Number of probes to find each key: 5:1, 3:1,15:1, 25:3, 4:3, 13:1,16:2

Average number of probes to find a key: (1+1+1+3+3+1+2)/7=1.71

c) double hashing:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 16 |  | 13 | 3 | 15 | 5 |  |  | 25 | 4 |  |

Number of probes to find each key: 5:1, 3:1, 15:1, 25:2, 4:2,13:1,16:3

Average number of probes to find a key: (1+1+1+2+2+1+3)/7=1.57

a) Mergesort tree: (feel free to continue tree in text mode)

45 27 20 25 **⏐** 26 12 40 28 **→** 12 20 25 26 27 28 40 45

1 **→** 1

/ \

/ \

45 27 20 25 🡪 20 25 27 45 26 12 40 28 🡪 12 26 28 40

/ \ / \

45 27 🡪 27 45 20 25🡪 20 25 26 12🡪12 26 40 28🡪 28 40

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45🡪45 27🡪27 20🡪20 25🡪25 26🡪26 12🡪12 40🡪40 28🡪 28

b) Quicksort table: (feel free to add more rows)

|  |  |  |
| --- | --- | --- |
| a | b | S 0 1 2 3 4 5 6 7 |
| - | - | [45, 27, 20, 25, 26, 12, 40, 28] |
| 0 | 7 | [12, 27, 20, 25, 26, 28, 40, 45] |
| 0 | 4 | [12, 25 ,20, 26, 27, 28, 40, 45] |
| 0 | 2 | [12, 25, 20, 26, 27, 28, 40, 45] |
| 6 | 7 | [12, 20, 25, 26, 27, 28, 40, 45] |