W3D5 Assignment

Question 1

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | A | B | C | D | E | F | G | H | I |
| A | 0 | 22 | 9 | 12 | 0 | 0 | 0 | 0 | 0 |
| B | 22 | 0 | 35 | 0 | 0 | 36 | 0 | 34 | 0 |
| C | 9 | 35 | 0 | 4 | 65 | 42 | 0 | 0 | 0 |
| D | 12 | 0 | 4 | 0 | 33 | 0 | 0 | 0 | 30 |
| E | 0 | 0 | 65 | 33 | 0 | 18 | 23 | 0 | 0 |
| F | 0 | 36 | 42 | 0 | 18 | 0 | 39 | 24 | 0 |
| G | 0 | 0 | 0 | 0 | 23 | 39 | 0 | 25 | 21 |
| H | 0 | 34 | 0 | 0 | 0 | 24 | 25 | 0 | 19 |
| I | 0 | 0 | 0 | 30 | 0 | 0 | 21 | 19 | 0 |

Question 2

|  |  |
| --- | --- |
| A[A] = 0……Selected A[A]=0 | A[H] = 22+34 = 56 A[A]=0  A[F] = 22+36 = 58 A[C]=9  A[F] = 9+42 = 51 A[D]=12  A[E] = 9+65 = 74 A[B]=22  A[E] = 12+33 = 45…….. Selected A[I]=42  A[G] = 42+21 = 63 A[E]=45  A[H] = 42+19 =61 |
| A[B] = 0+22 = 22 A[A]=0  A[C] = 0+9 = 9………. Selected A[C]=9  A[D] = 0+12 = 12 | A[H] = 22+34 = 56 A[A]=0  A[F] = 22+36 = 58 A[C]=9  A[F] = 9+42 = 51…….Selected A[D]=12  A[G] = 42+21 = 63 A[B]=22  A[H] = 42+19 = 61 A[I]=42  A[G] = 45+23 = 68 A[E]=45  A[F] = 45+18 = 63 A[F]=51 |
| A[B] = 0+22 = 22 A[A]=0  A[D] = 0 +12 = 12……. Selected A[C]=9  A[B] = 9+35 = 44 A[D]=12  A[D] = 9+4 =13  A[E] = 9+65 = 74  A[F] = 9+42 = 51 | A[H] = 22+34 = 56…… Selected A[A]=0  A[H] = 51+24 = 75 A[C]=9  A[G] = 51+39 = 90 A[D]=12  A[G] = 45+23 = 68 A[B]=22  A[G] = 42+21 = 63 A[I]=42  A[H] = 42+19 = 61 A[E]=45  A[F]=51  A[H]=56 |
| A[B] = 0+22 =22……. Selected A[A]=0  A[B] = 9+35 = 44 A[C]=9  A[F] = 9+42 = 51 A[D]=12  A[E] = 9+65 = 74 A[B]=22  A[E] = 12+33 = 45  A[I] = 12+30 = 42 | A[G] = 51+39 = 90 A[A]=0  A[G] = 45+23 = 68 A[C]=9  A[G] = 42+21 = 63…. Selected A[D]=12  A[G] = 56+25 = 81 A[B]=22  A[I]=42  A[E]=45  A[F]=51  A[H]=56  A[G]=63 |
| A[H] = 22+34 = 56 A[A]=0  A[F] = 22+36 = 58 A[C]=9  A[F] = 9+42 = 51 A[D]=12  A[E] = 9+65 = 74 A[B]=22  A[E] = 12+33 = 45 A[I]=42  A[I] = 12+30 = 42……. Selected |  |

The shortest path from A to all other vertices is

A[A] = 0, A[C] = 9, A[D] =12, A[B] = 22, A[I] = 42, A[E] = 45, A[F] = 51, A[H] = 56, A[G] = 63

Question 3

Question 4

Sorting all edges by edge weight

1. (C,D) = 4
2. (A,C) = 9
3. (A,D) = 12
4. (E,F) = 18
5. (H,I) = 19
6. (G,I) = 21
7. (A,B) =22
8. (E,G) =23
9. (F,H) = 24
10. (G,H) = 25
11. (D,I) = 30
12. (D,E) = 33
13. (B,H) = 34
14. (B,C) = 35
15. (B,F) =36
16. (F,G) = 39
17. (C,F) = 65

Selecting edges

|  |  |
| --- | --- |
| Select | Select |
| Select | Select |
| Delete | Delete |
| Select | Delete |
| Select | Select |
| Select | Since all the vertices are visited, it can be concluded that we have found the minimum spanning tree with edges  { (C,D),(A,C),(E,F),(H,I),(G,I),(A,B),(E,G),(D,I) } |

Question 5

Question 6

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | P | Q | R | S | T | U |
| P | 0 | 1 | 0 | 6 | 7 | 0 |
| Q | 0 | 0 | 1 | 4 | 0 | 0 |
| R | 0 | 0 | 0 | 2 | 0 | 1 |
| S | 0 | 0 | 0 | 0 | 3 | 2 |
| T | 0 | 0 | 0 | 0 | 0 | 2 |
| U | 0 | 0 | 0 | 0 | 0 | 0 |

Question 7

Topological Sort result = PQRSTU

|  |  |
| --- | --- |
| A[P] = 0……Selected A[P]=0 | A[S] = A[P] + wt(P,S) = 0+6 = 6  A[S] = A[Q] + wt(Q,S) = 1+4 = 5  A[S] = A[R] + wt(R,S) = 2+2 = 4……. Selected  A[P] = 0  A[Q] = 1  A[R] = 2  A[S] = 4 |
| A[Q] = 0+1 = 1……Selected A[P]=0  A[Q]=1 | A[T] = A[P] + wt(P,T) = 0+7 = 7  A[T] = A[S] + wt(T,S) = 4+3 = 7……. Selected  A[P] = 0  A[Q] = 1  A[R] = 2  A[S] = 4  A[T] = 7 |
| A[R] = 1+1 = 2…… Selected A[P]=0  A[Q]=1  A[R]=2 | A[U] = A[S] + wt(S,U) = 4+2 = 6  A[U] = A[T] + wt(T,U) = 7+2 = 9  A[U] = A[R] + wt(R,U) = 2+1 = 3……. Selected  A[P] = 0  A[Q] = 1  A[R] = 2  A[S] = 4  A[T] = 7  A[U] = 3 |

Shortest path from P to U is P – Q – R – U = 3

Question 8

Question 9

No, because the algorithm on slide 12 is only applicable for undirected weighted graphs.

10. If “Yes”, find the shortest path from P to U using Dijkstra’s algorithm (Slide 12) (Figure 2).

I answered “No” in question 9.