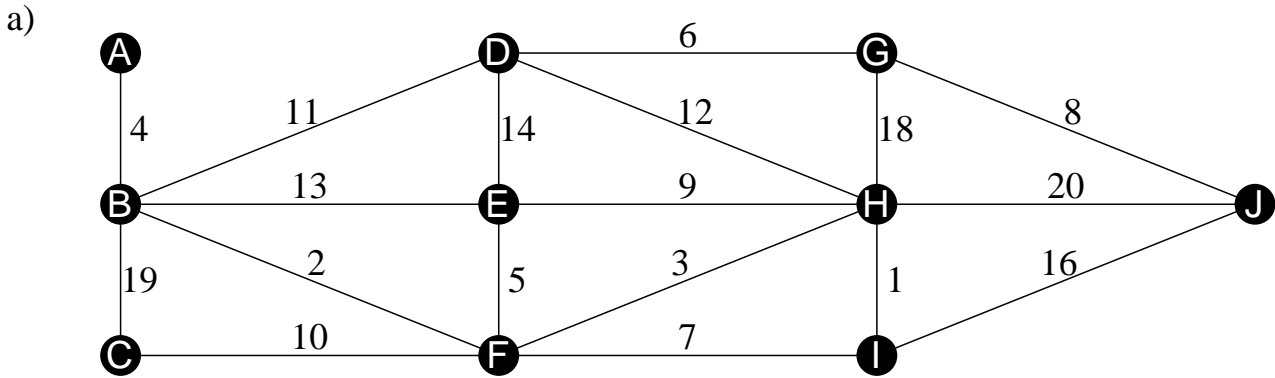
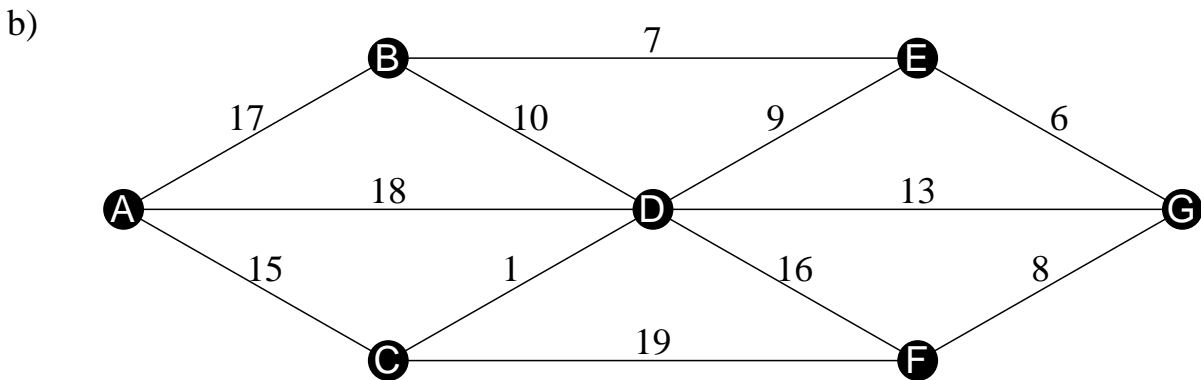


# Miscellaneous Discrete 1

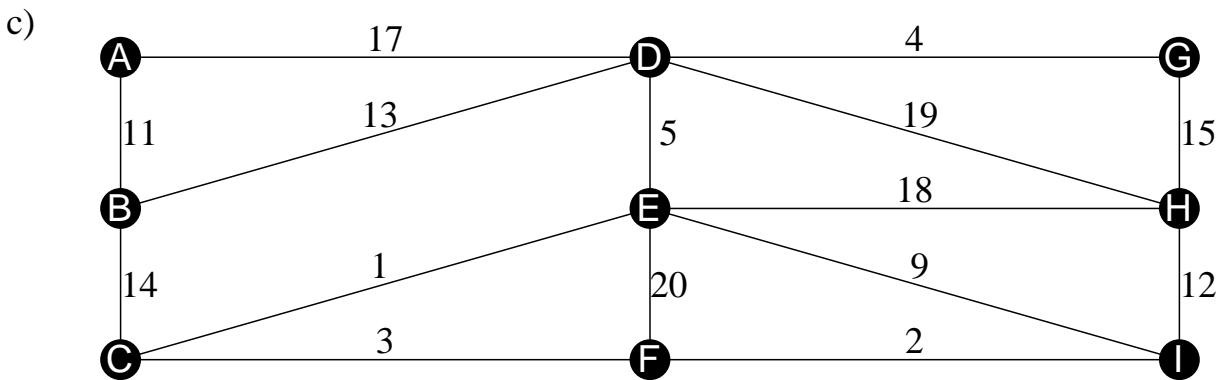
1: Find the Minimum Spanning Tree using Prim's Algorithm starting from vertex A:



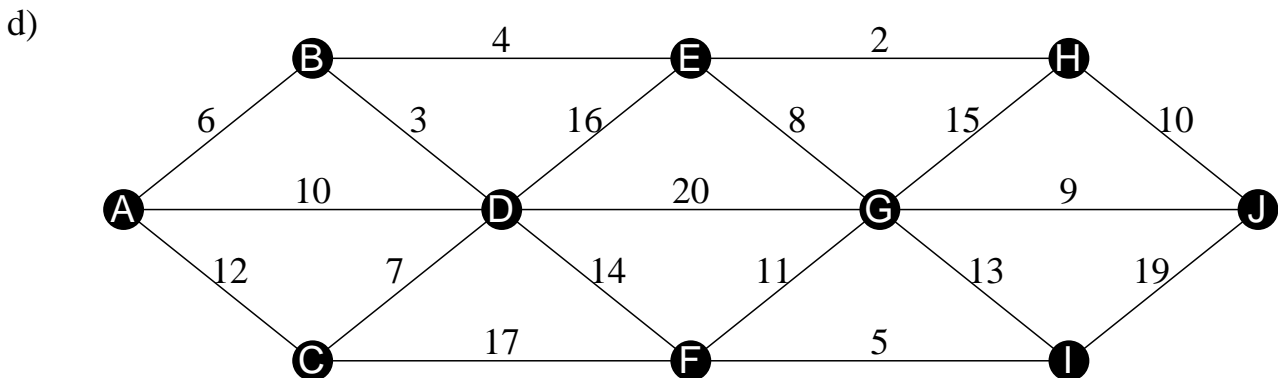
Arcs/Length:



Arcs/Length:

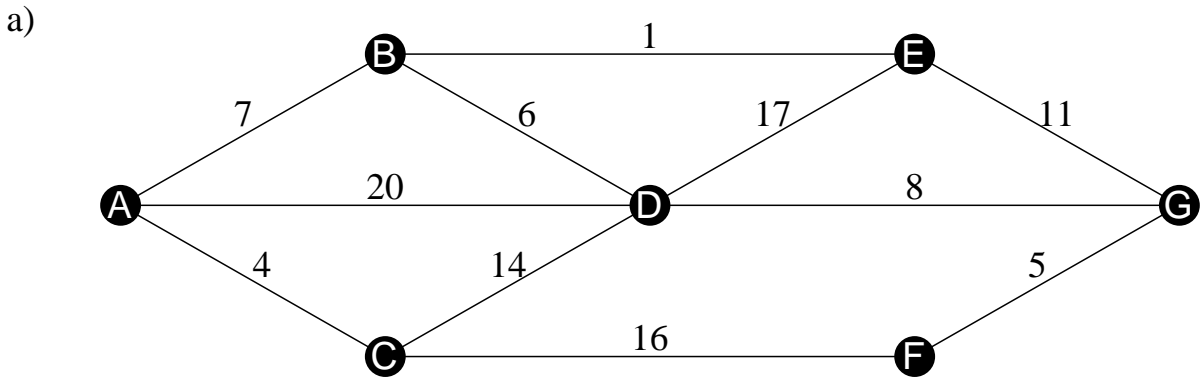


Arcs/Length:

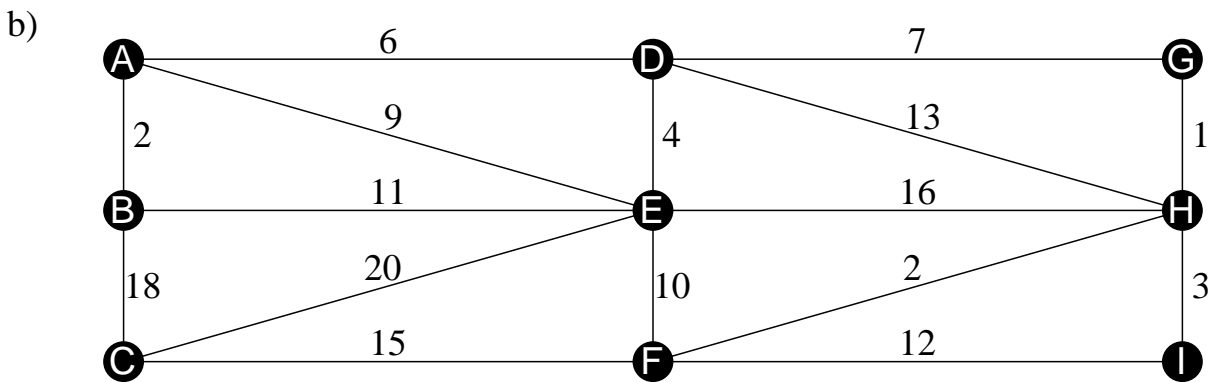


Arcs/Length:

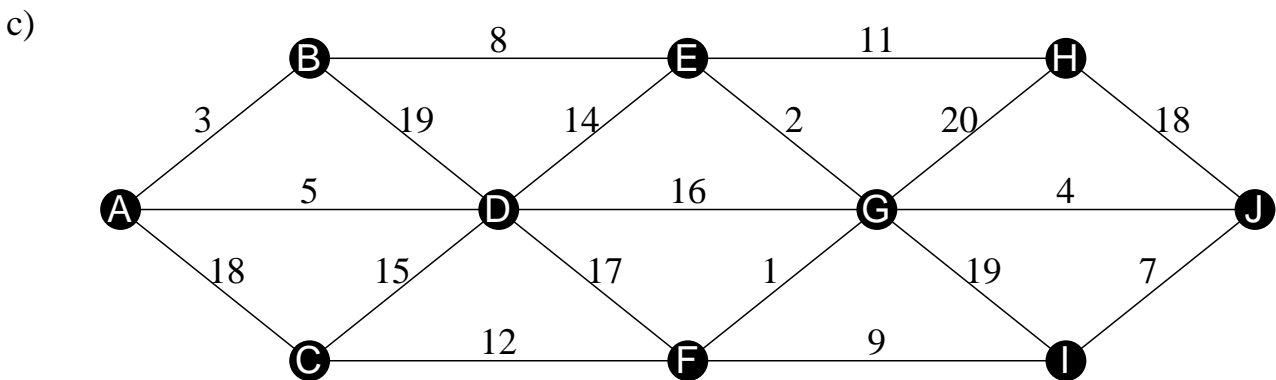
2: Find the Minimum Spanning Tree using Kruskal's Algorithm:



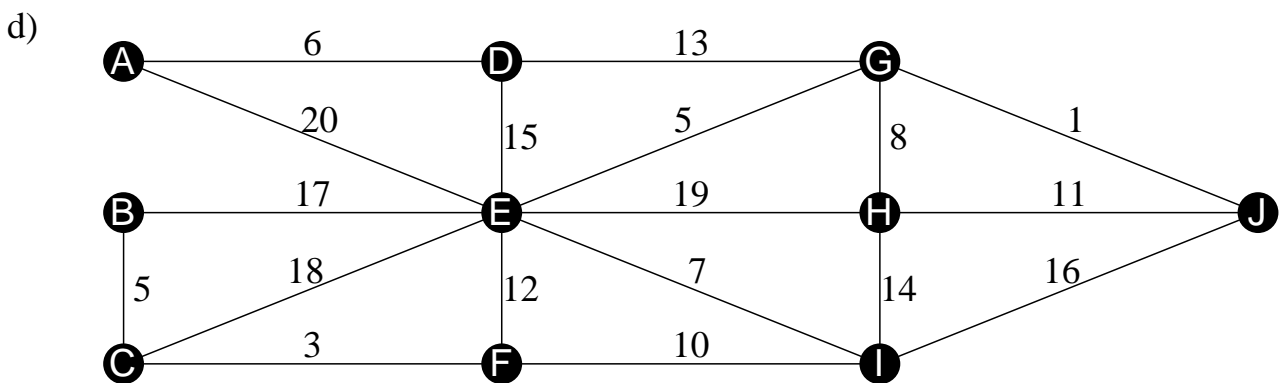
Arcs/Length:



Arcs/Length:



Arcs/Length:



Arcs/Length:

3: Find the Minimum Spanning Tree using Prim's Algorithm starting from vertex A:

a)

	A	B	C	D	E
A	-	11	4	5	17
B	11	-	15	10	8
C	4	15	-	9	25
D	5	10	9	-	2
E	17	8	25	2	-

Arcs:

Total length=

b)

	A	B	C	D	E	F
A	-	13	3	19	16	26
B	13	-	23	12	7	6
C	3	23	-	30	1	29
D	19	12	30	-	28	22
E	16	7	1	28	-	14
F	26	6	29	22	14	-

Arcs:

Total length=

c)

	A	B	C	D	E	F	G
A	-	18	20	24	21	27	25
B	18	-	4	11	2	3	16
C	20	4	-	8	17	26	15
D	24	11	8	-	13	6	28
E	21	2	17	13	-	23	9
F	27	3	26	6	23	-	12
G	25	16	15	28	9	12	-

Arcs:

Total length=

d)

	A	B	C	D	E	F	G
A	-	14	5	10	18	22	7
B	14	-	1	29	21	30	19
C	5	1	-	20	24	27	8
D	10	29	20	-	17	16	26
E	18	21	24	17	-	11	4
F	22	30	27	16	11	-	3
G	7	19	8	26	4	3	-

Arcs:

Total length=

e)

	A	B	C	D	E
A	-	14	22	10	25
B	14	-	5	13	2
C	22	5	-	12	18
D	10	13	12	-	27
E	25	2	18	27	-

Arcs:

Total length=

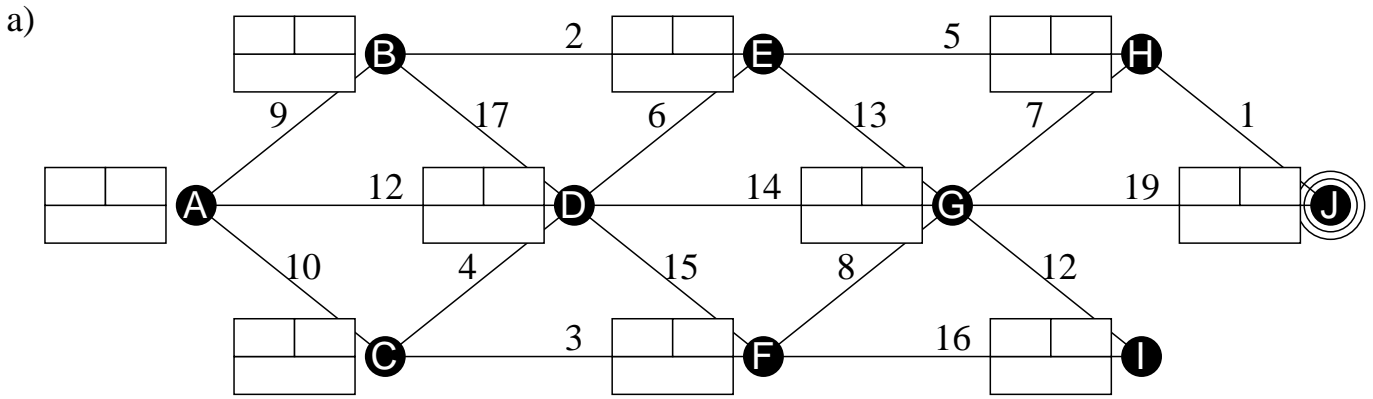
f)

	A	B	C	D	E	F
A	-	23	20	9	1	28
B	23	-	24	30	19	29
C	20	24	-	15	7	6
D	9	30	15	-	21	11
E	1	19	7	21	-	4
F	28	29	6	11	4	-

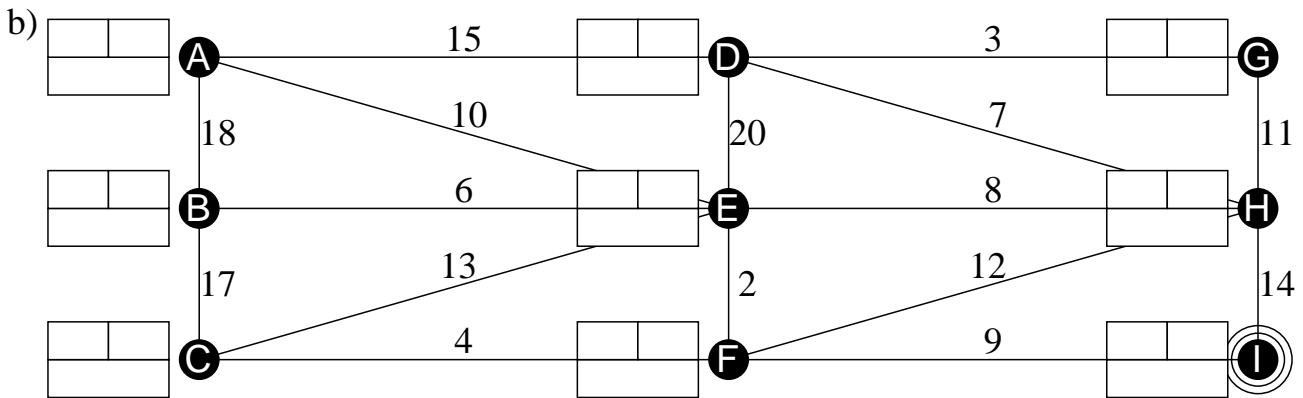
Arcs:

Total length=

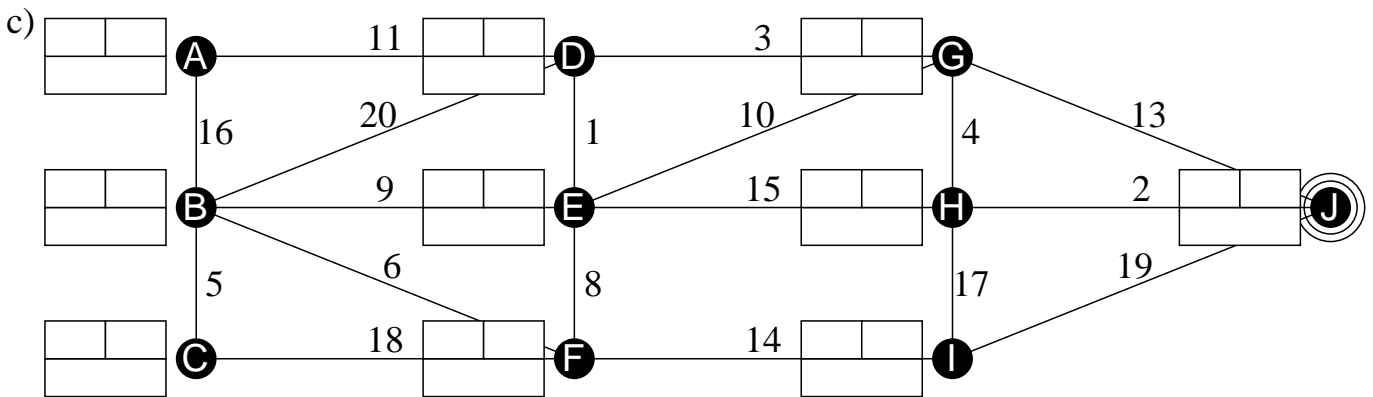
4: Find the shortest route from A to the ringed vertex using Dijkstra's Algorithm:



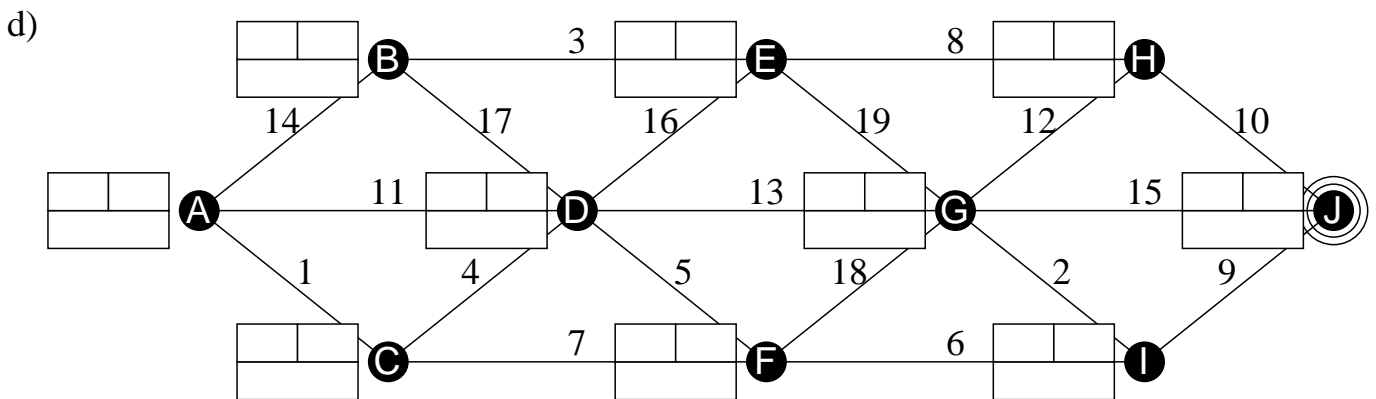
Route/Length:



Route/Length:



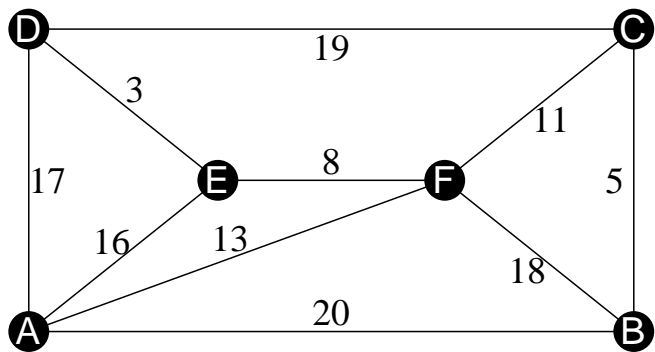
Route/Length:



Route/Length:

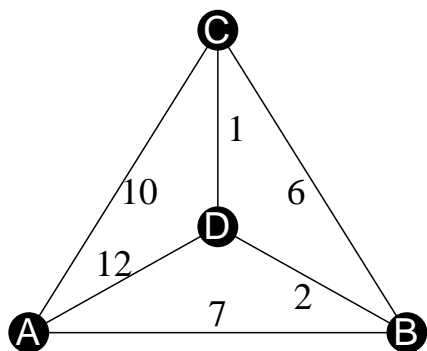
5: Pair the odd nodes so that the edges joining them have least total weight.

a)



Pairings/Best solution:

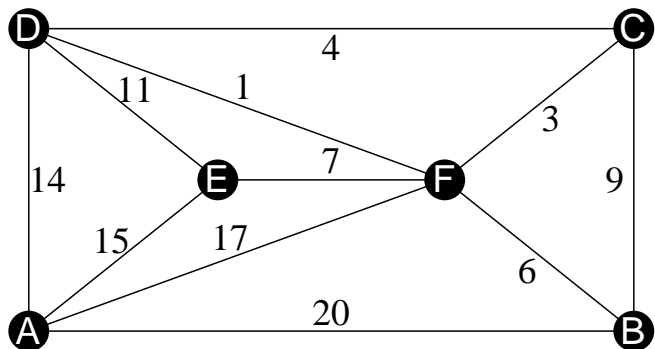
b)



Pairings/Best solution:

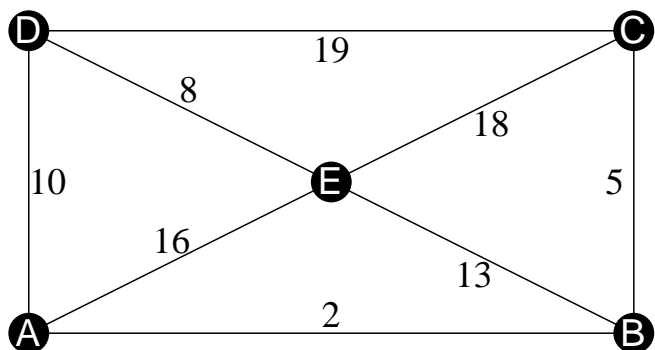
6: Find the shortest route starting and finishing at A which includes every edge.

a)



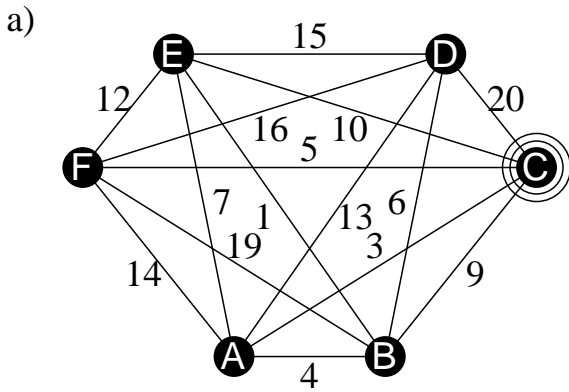
Pairings/Best solution:

b)

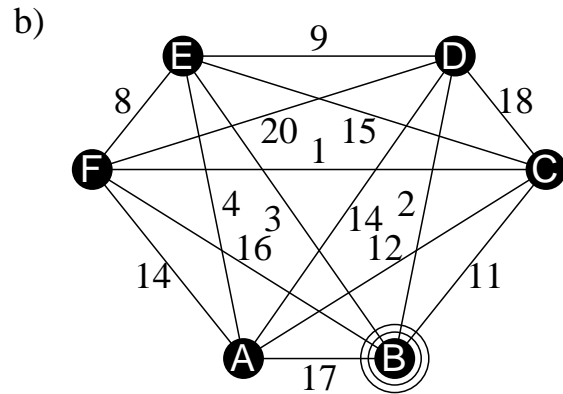


Pairings/Best solution:

7: Find a Hamiltonian cycle using the Nearest Neighbour algorithm (start at the ringed vertex):

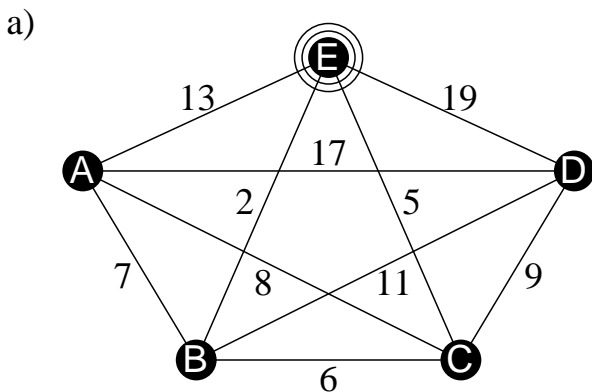


Cycle/Length:

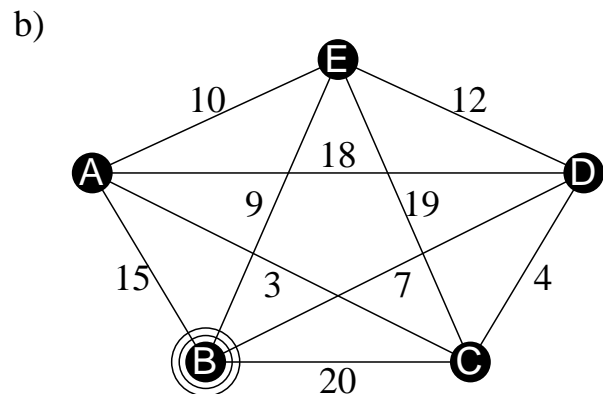


Cycle/Length:

8: Find a lower bound for the Travelling Salesperson Problem (remove the ringed vertex):



Lower Bound:



Lower Bound:

9: Use the first fit algorithm to pack these objects into bins:

a) 10 3 6 12 6 2 4 11  
(Bin size 18)

b) 8 2 2 2 9 10 2 11 7 11 16  
(Bin size 20)

c) 4 9 4 2 4 3 10 3 7 8 9 2  
(Bin size 13)

d) 10 6 2 12 6 2 10  
(Bin size 16)

10: Use the first fit decreasing algorithm to pack these objects into bins:

a) 7 2 3 7 6 2 10 4 3 4 2 10 5 8 12  
(Bin size 15)

b) 11 8 4 7 14 6 5 9 8 3 4 1  
(Bin size 19)

c) 9 5 6 6 2 12 2  
(Bin size 14)

d) 3 5 8 12 6 2 6 11 2 1 15 6 14  
(Bin size 17)

11: Use the full bin algorithm to pack these objects into bins:

a) 8 5 7 2 10 4 2 3 2 1 7  
(Bin size 11)

b) 3 1 3 1 2 6 4 8 6 1 5  
(Bin size 10)

c) 2 1 2 7 3 9 1 8 10 3 10 11  
(Bin size 12)

d) 5 3 14 7 4 8 13  
(Bin size 18)

12: Arrange the following lists in ascending order using Bubble Sort:

a) 9 7 10 5 2

b) 9 13 3 16 4 10 6

c) 6 1 9 13 3 12

d) 5 1 8 9 3

13: Arrange the following lists in ascending order using Shuttle Sort:

a) 9 2 6 11 5 10

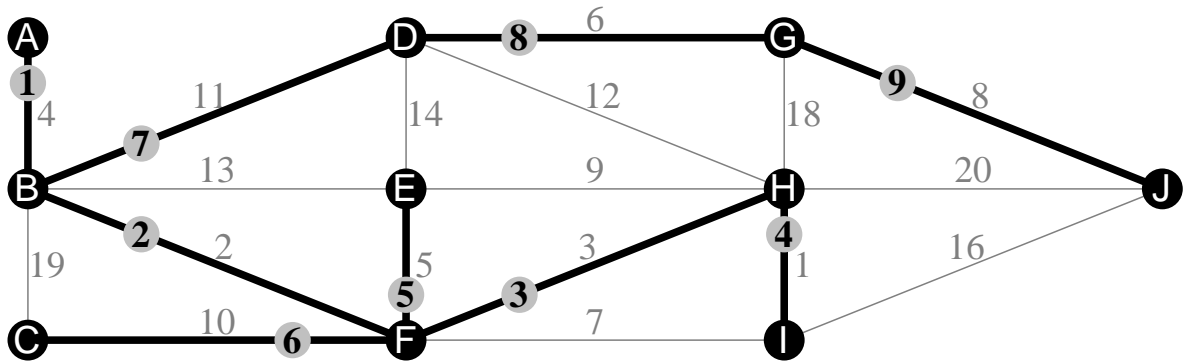
b) 13 5 2 1 9 12 8

c) 6 3 9 11 7

d) 9 13 1 10 7 4

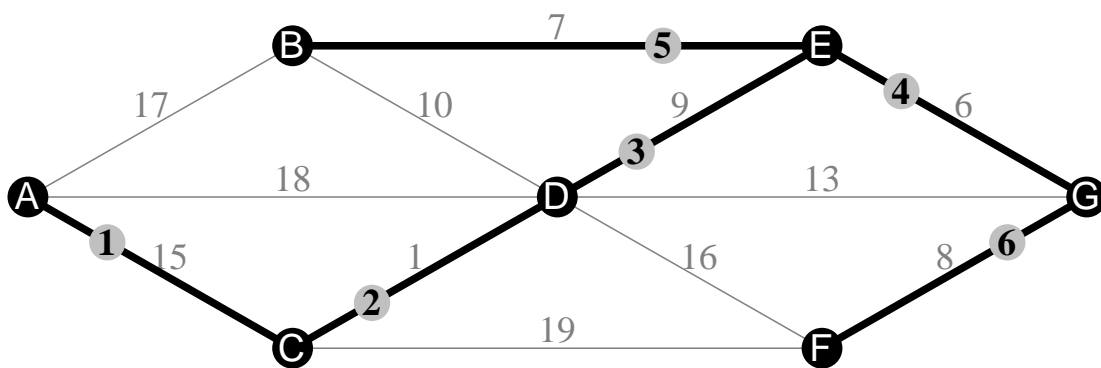
# Answers: Miscellaneous Discrete 1

1: a)



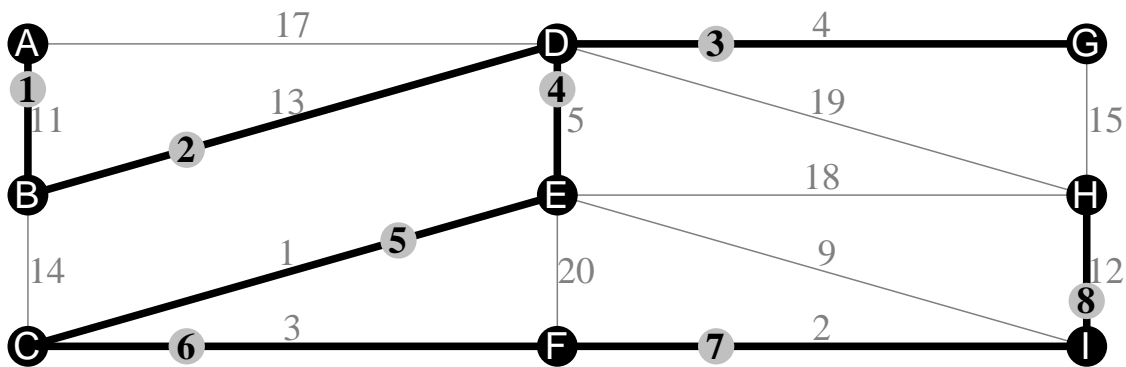
Arcs: AB, BF, FH, HI, FE, FC, BD, DG, GJ. Total length=50

b)



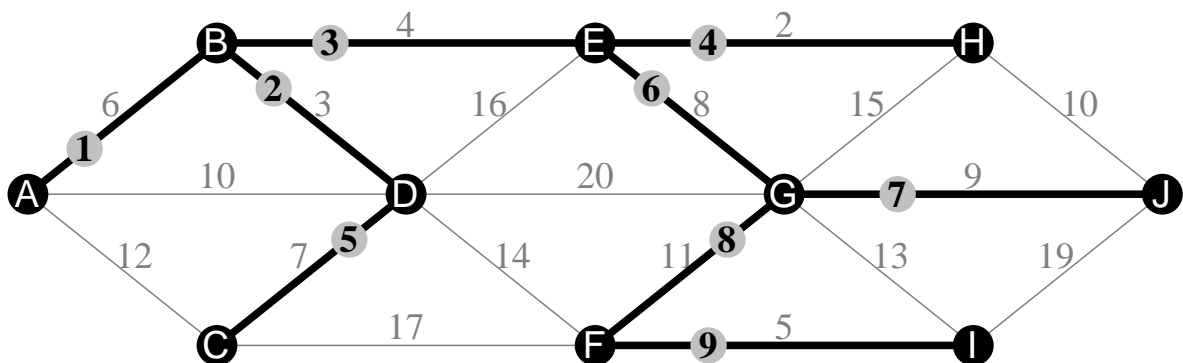
Arcs: AC, CD, DE, EG, EB, GF. Total length=46

c)



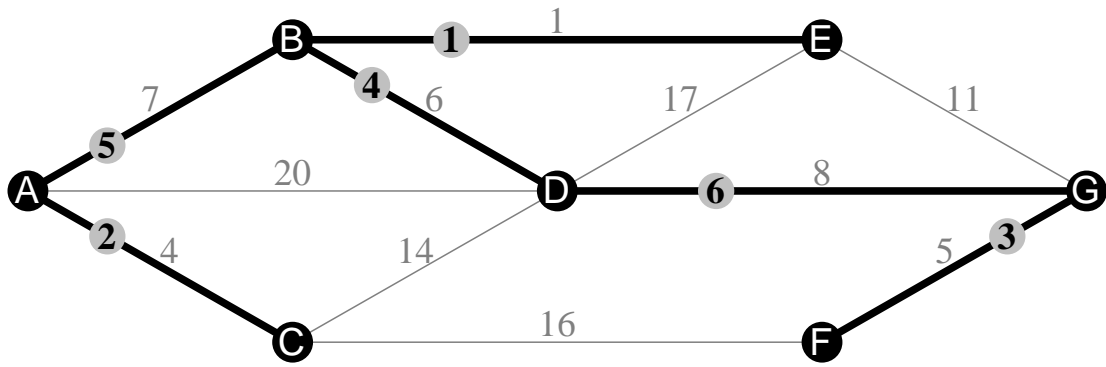
Arcs: AB, BD, DG, DE, EC, CF, FI, IH. Total length=51

d)



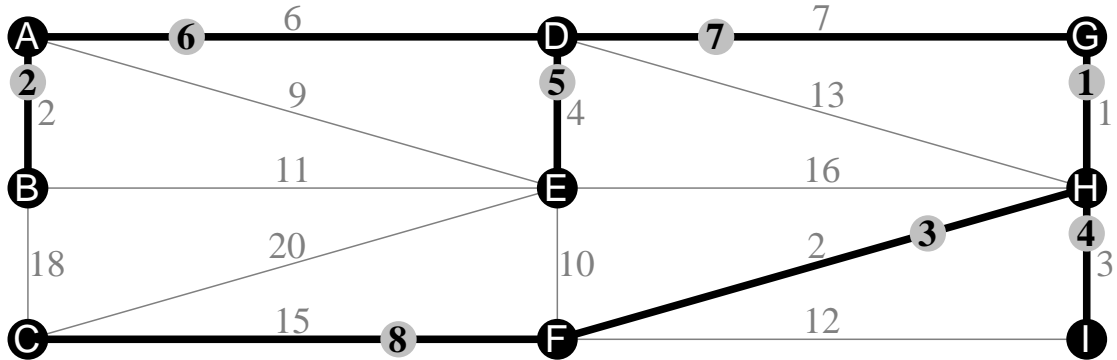
Arcs: AB, BD, BE, EH, DC, EG, GJ, GF, FI. Total length=55

2: a)



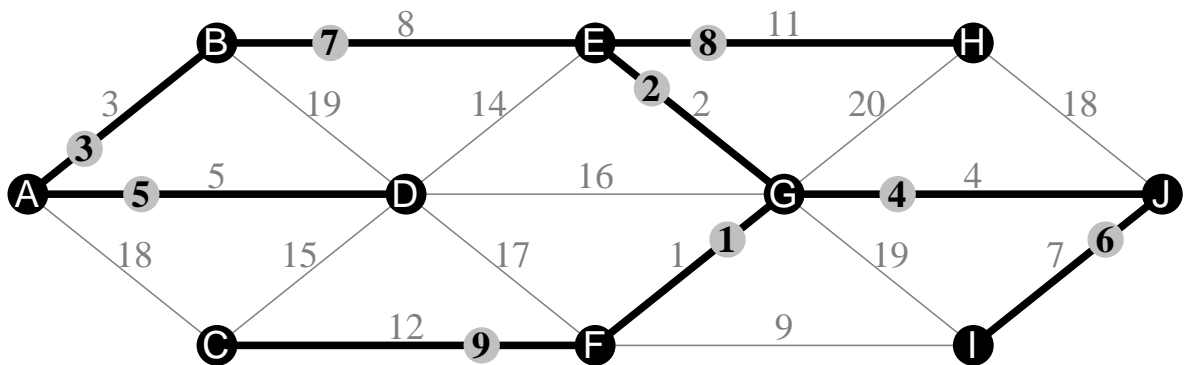
Arcs: BE, AC, GF, BD, AB, DG. Total length=31

b)



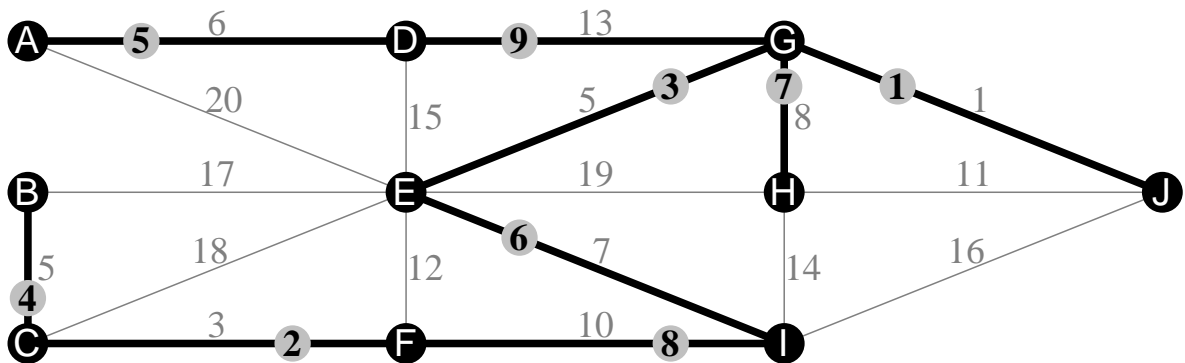
Arcs: GH, AB, HF, HI, DE, AD, DG, FC. Total length=40

c)



Arcs: GF, EG, AB, GJ, AD, JI, BE, EH, FC. Total length=53

d)



Arcs: GJ, FC, GE, CB, AD, EI, GH, IF, DG. Total length=58

3: a)

	A <sub>1</sub>	B <sub>5</sub>	C <sub>2</sub>	D <sub>3</sub>	E <sub>4</sub>
A	—	11	4	5	17
B	11	—	15	10	(8)
C	(4)	15	—	9	25
D	(5)	10	9	—	2
E	17	8	25	(2)	—

Arcs: AC, AD, DE, EB.

Total length=19

b)

	A <sub>1</sub>	B <sub>4</sub>	C <sub>2</sub>	D <sub>6</sub>	E <sub>3</sub>	F <sub>5</sub>
A	—	13	3	19	16	26
B	13	—	23	12	(7)	6
C	(3)	23	—	30	1	29
D	19	(12)	30	—	28	22
E	16	7	(1)	28	—	14
F	26	(6)	29	22	14	—

Arcs: AC, CE, EB, BF, BD.

Total length=29

c)

	A <sub>1</sub>	B <sub>2</sub>	C <sub>5</sub>	D <sub>6</sub>	E <sub>3</sub>	F <sub>4</sub>	G <sub>7</sub>
A	—	18	20	24	21	27	25
B	(18)	—	4	11	2	3	16
C	20	(4)	—	8	17	26	15
D	24	11	8	—	13	(6)	28
E	21	(2)	17	13	—	23	9
F	27	(3)	26	6	23	—	12
G	25	16	15	28	(9)	12	—

Arcs: AB, BE, BF, BC, FD, EG.

Total length=42

d)

	A <sub>1</sub>	B <sub>3</sub>	C <sub>2</sub>	D <sub>7</sub>	E <sub>6</sub>	F <sub>5</sub>	G <sub>4</sub>
A	—	14	5	10	18	22	7
B	14	—	(1)	29	21	30	19
C	(5)	1	—	20	24	27	8
D	(10)	29	20	—	17	16	26
E	18	21	24	17	—	11	(4)
F	22	30	27	16	11	—	(3)
G	(7)	19	8	26	4	3	—

Arcs: AC, CB, AG, GF, GE, AD.

Total length=30

e)

	A <sub>1</sub>	B <sub>4</sub>	C <sub>3</sub>	D <sub>2</sub>	E <sub>5</sub>
A	—	14	22	10	25
B	14	—	(5)	13	2
C	22	5	—	(12)	18
D	(10)	13	12	—	27
E	25	(2)	18	27	—

Arcs: AD, DC, CB, BE.

Total length=29

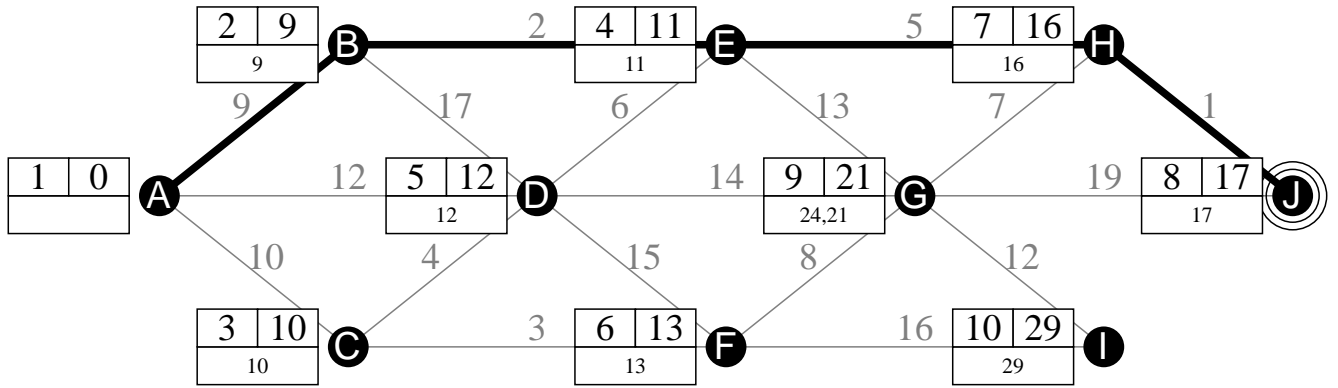
f)

	A <sub>1</sub>	B <sub>6</sub>	C <sub>4</sub>	D <sub>5</sub>	E <sub>2</sub>	F <sub>3</sub>
A	—	23	20	9	1	28
B	23	—	24	30	(19)	29
C	20	24	—	15	7	(6)
D	(9)	30	15	—	21	11
E	(1)	19	7	21	—	4
F	28	29	6	11	(4)	—

Arcs: AE, EF, FC, AD, EB.

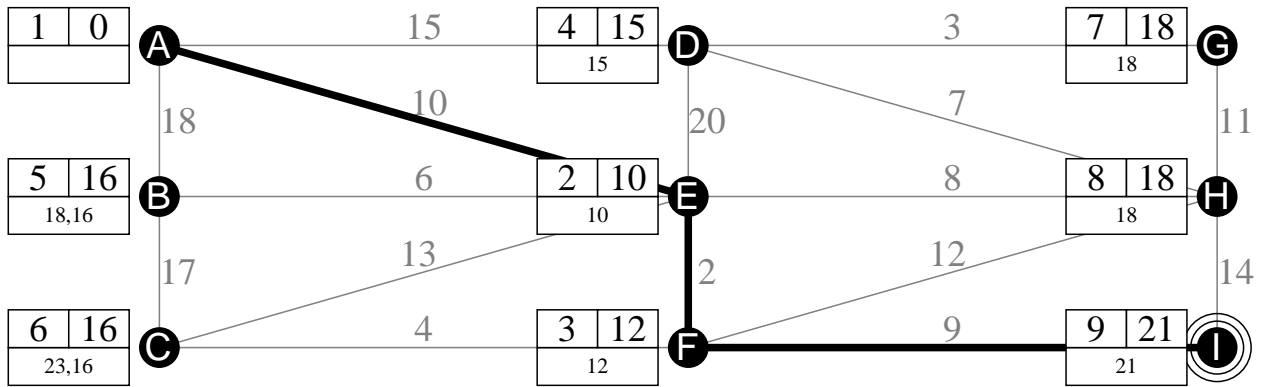
Total length=39

4: a)



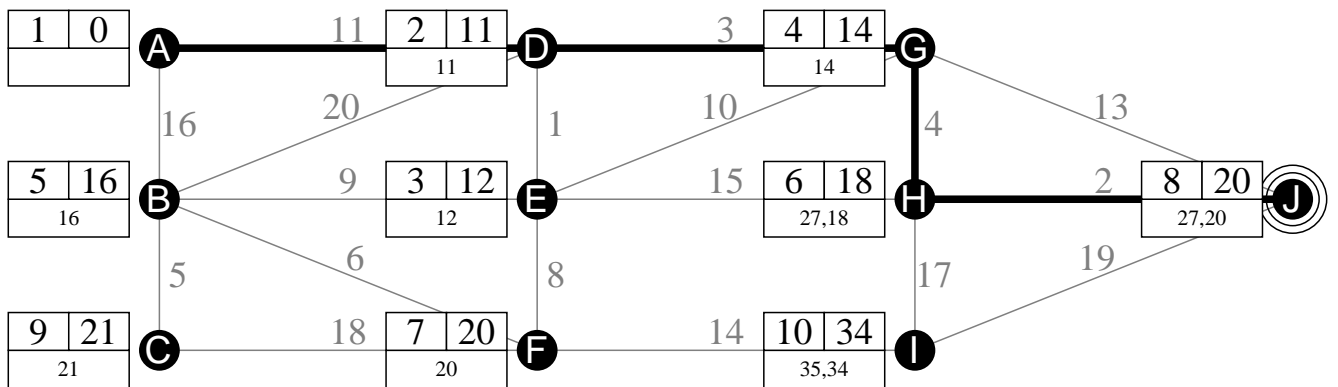
Route: ABEHJ. Length=17

b)



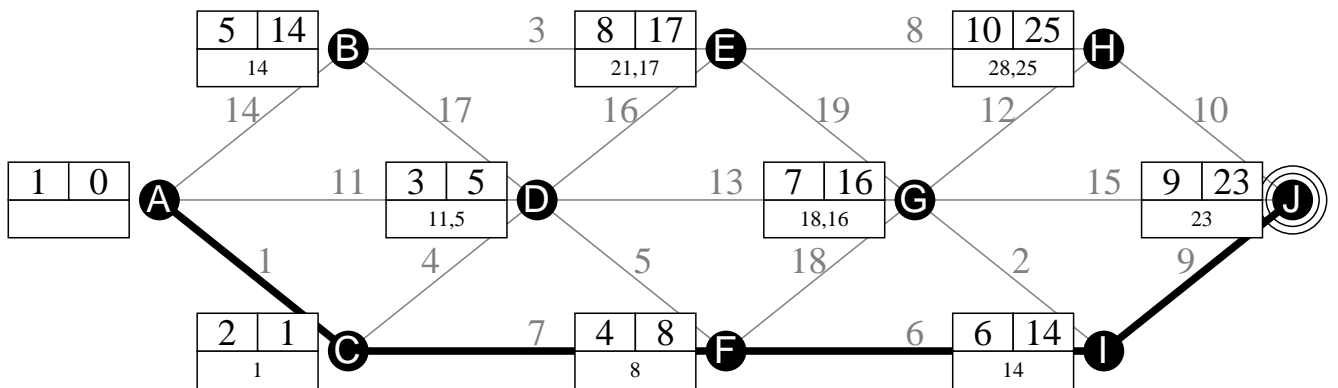
Route: AEFI. Length=21

c)



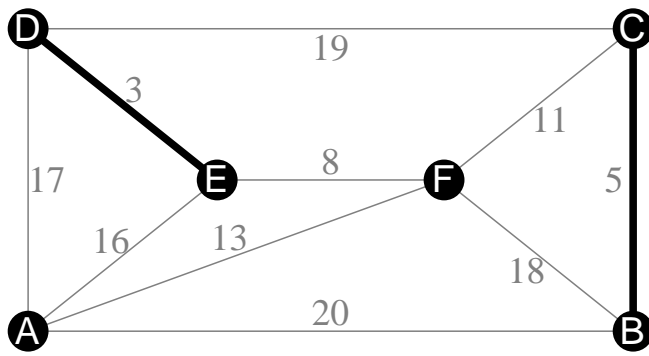
Route: ADGHJ. Length=20

d)



Route: ACFIJ. Length=23

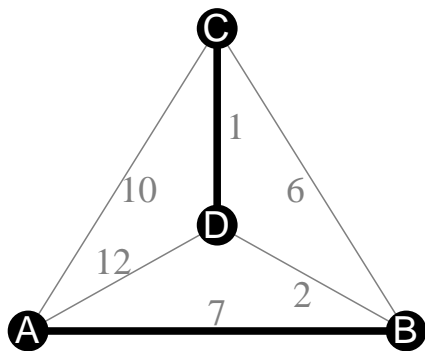
5: a)



Pairings: BC: 5	BD: 24	BE: 24
DE: 3	CE: 19	CD: 19
Tot: <b>8</b>	Tot: 43	Tot: 43

Least total weight=8

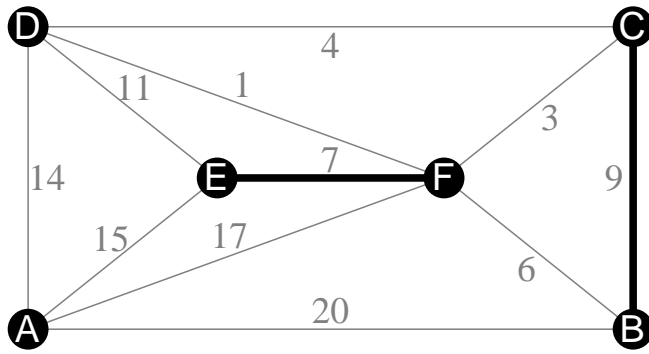
b)



Pairings: AB: 7	AC: 10	AD: 9
CD: 1	BD: 2	BC: 3
Tot: <b>8</b>	Tot: 12	Tot: 12

Least total weight=8

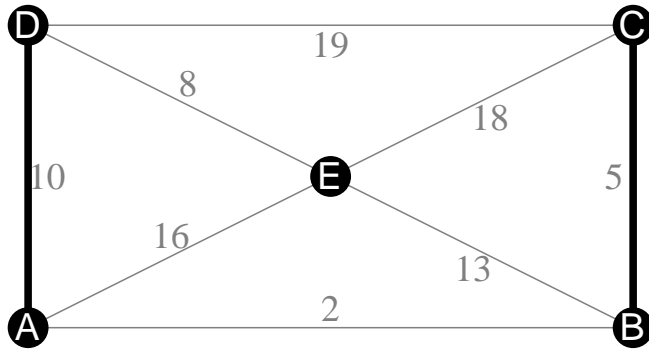
6: a)



Pairings: BC: 9    BE: 13    BF: 6  
 EF: 7    CF: 3    CE: 10  
 Tot: 16    Tot: 16    Tot: 16

Poss. route: ABCBFADCFDEFEA  
 Length:  $107 + 16 = 123$

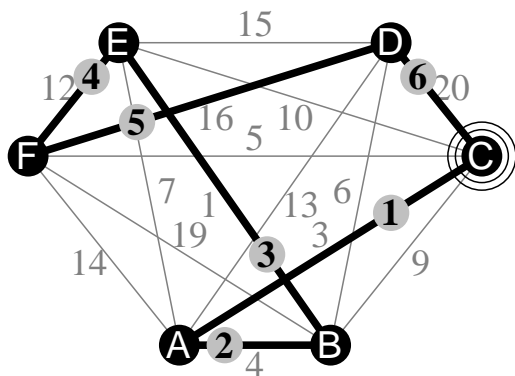
b)



Pairings: AB: 2    AC: 7    AD: 10  
 CD: 17    BD: 12    BC: 5  
 Tot: 19    Tot: 19    Tot: 15

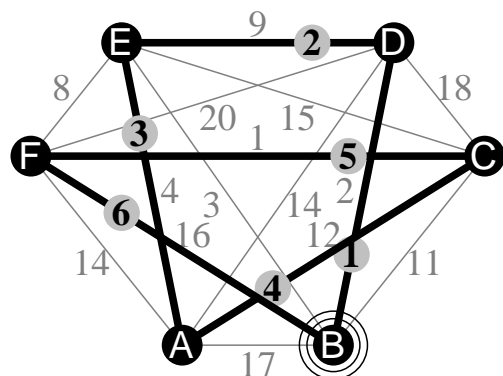
Poss. route: ABCBEADCEDA  
 Length:  $91 + 15 = 106$

7: a)



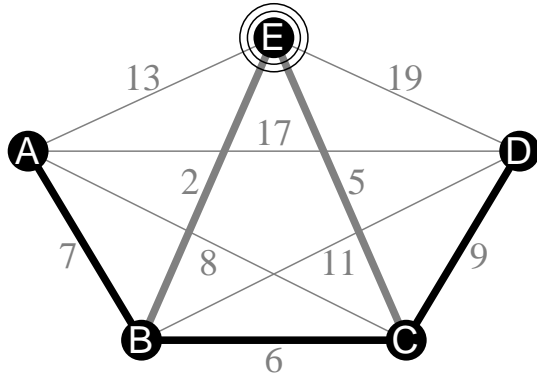
Cycle: CABEFDC. Length=56

b)



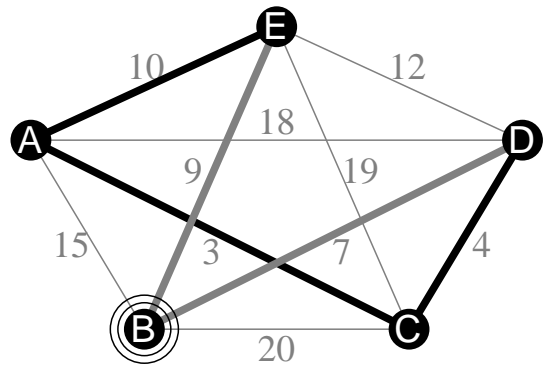
Cycle: BDEACFB. Length=44

8: a)



Length = 7 + 22 = 29

b)



Length = 16 + 17 = 33

9: a) 10 3 6 12 6 2 4 11

(Bin size 18)

Bin 1: 10 3 2 [15]

Bin 2: 6 12 [18]

Bin 3: 6 4 [10]

Bin 4: 11 [11]

b) 8 2 2 2 9 10 2 11 7 11 16

(Bin size 20)

Bin 1: 8 2 2 2 2 [16]

Bin 2: 9 10 [19]

Bin 3: 11 7 [18]

Bin 4: 11 [11]

Bin 5: 16 [16]

c) 4 9 4 2 4 3 10 3 7 8 9 2

(Bin size 13)

Bin 1: 4 9 [13]

Bin 2: 4 2 4 3 [13]

Bin 3: 10 3 [13]

Bin 4: 7 2 [9]

Bin 5: 8 [8]

Bin 6: 9 [9]

d) 10 6 2 12 6 2 10

(Bin size 16)

Bin 1: 10 6 [16]

Bin 2: 2 12 2 [16]

Bin 3: 6 10 [16]

- 10: a) 12 10 10 8 7 7 6 5 4 4 3 3 2 2 2  
(Bin size 15)  
Bin 1: 12 3 [15]  
Bin 2: 10 5 [15]  
Bin 3: 10 4 [14]  
Bin 4: 8 7 [15]  
Bin 5: 7 6 2 [15]  
Bin 6: 4 3 2 2 [11]
- b) 14 11 9 8 8 7 6 5 4 4 3 1  
(Bin size 19)  
Bin 1: 14 5 [19]  
Bin 2: 11 8 [19]  
Bin 3: 9 8 1 [18]  
Bin 4: 7 6 4 [17]  
Bin 5: 4 3 [7]
- c) 12 9 6 6 5 2 2  
(Bin size 14)  
Bin 1: 12 2 [14]  
Bin 2: 9 5 [14]  
Bin 3: 6 6 2 [14]
- d) 15 14 12 11 8 6 6 6 5 3 2 2 1  
(Bin size 17)  
Bin 1: 15 2 [17]  
Bin 2: 14 3 [17]  
Bin 3: 12 5 [17]  
Bin 4: 11 6 [17]  
Bin 5: 8 6 2 1 [17]  
Bin 6: 6 [6]

11: a) 8 3 2 7 2 5 2 4 10 1 7

(Bin size 11)

Bin 1: 8 3 [11]

Bin 2: 2 7 2 [11]

Bin 3: 5 2 4 [11]

Bin 4: 10 1 [11]

Bin 5: 7 [7]

b) 4 5 1 1 6 3 1 6 3 8 2

(Bin size 10)

Bin 1: 4 5 1 [10]

Bin 2: 1 6 3 [10]

Bin 3: 1 6 3 [10]

Bin 4: 8 2 [10]

c) 9 3 11 1 3 1 8 10 2 10 2 7

(Bin size 12)

Bin 1: 9 3 [12]

Bin 2: 11 1 [12]

Bin 3: 3 1 8 [12]

Bin 4: 10 2 [12]

Bin 5: 10 2 [12]

Bin 6: 7 [7]

d) 14 4 8 3 7 13 5

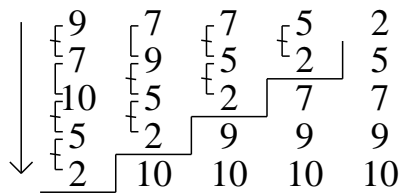
(Bin size 18)

Bin 1: 14 4 [18]

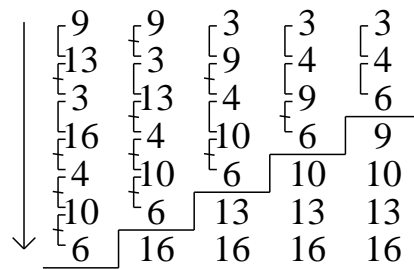
Bin 2: 8 3 7 [18]

Bin 3: 13 5 [18]

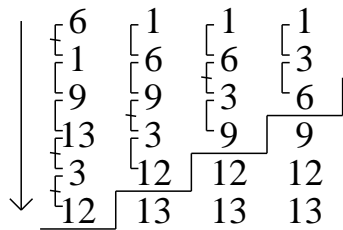
12: a)



b)



c)



d)

