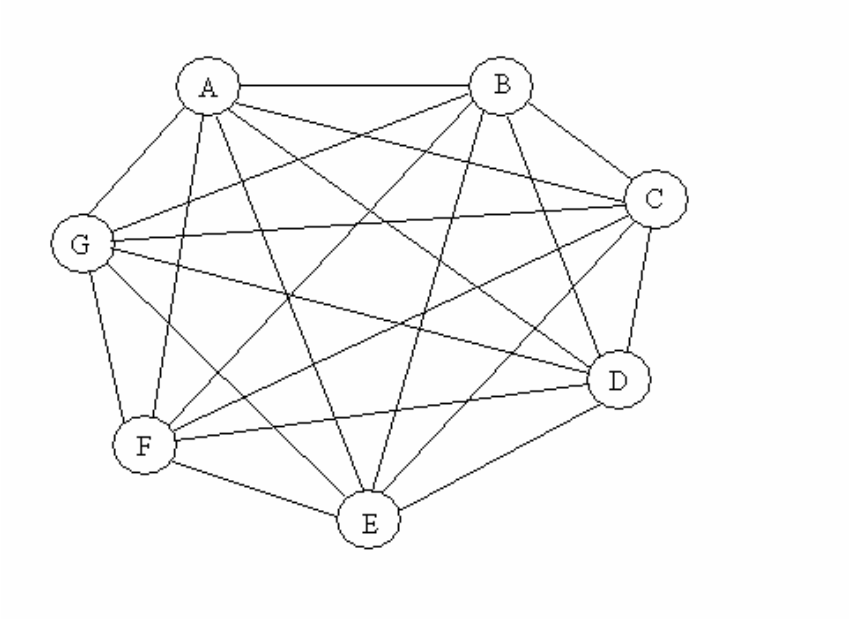
Esau-Williams Example

Determine the CMST design of the network with link cost given below

- Node A is the hub/center, all nodes have weight 1 except D which has weight 2
- The link capacity is W = 3

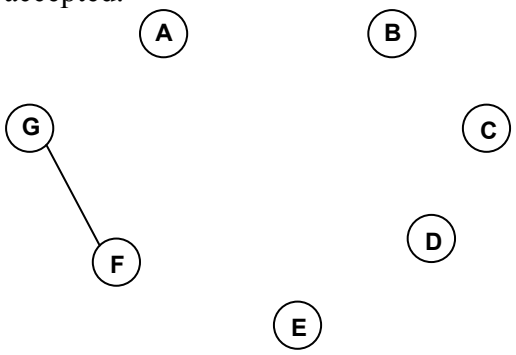


Node	B	C	D	E	F	G
A	5	6	9	10	11	15
B		9	6	6	8	17
C			7	9	8	12
D				10	5	11
E					14	9
F						8

Link Costs

Iteration 1:
Tradeoff (B) = Cost(B,D) – 5 = 6 – 5 = 1
Tradeoff (C) = Cost(C,D) – 6 = 7 – 6 = 1
Tradeoff (D) = Cost(D,F) – 9 = 5 – 9 = -4
Tradeoff (E) = Cost(E,B) – 10 = 6 – 10 = -4
Tradeoff (F) = Cost(F,D) – 11 = 5 – 11 = -6
Tradeoff (G) = Cost(G,F) – 15 = 8 – 15 = -7

Tradeoff (G) is the lowest. Since $\sum W_i = W_F + W_G = 1 + 1 = 2 \leq 3$, the link (G,F) is accepted.

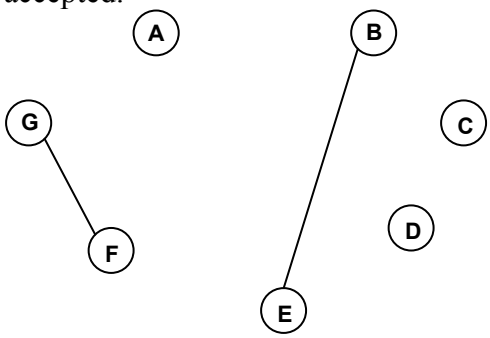


Iteration 2:
Tradeoff (B) = Cost(B,D) – 5 = 6 – 5 = 1, unchanged
Tradeoff (C) = Cost(C,D) – 6 = 7 – 6 = 1, unchanged
Tradeoff (D) = Cost(D,F) – 9 = 5 – 9 = -4, unchanged
Tradeoff (E) = Cost(E,B) – 10 = 6 – 10 = -4, unchanged
Tradeoff (F) = Cost(F,D) – 11 = 5 – 11 = -6, unchanged
Tradeoff (G) = Cost(G,E) – 11 = 9 – 11 = -2

Tradeoff (F) is the lowest. Since $\sum W_i = W_F + W_G + W_D = 1 + 1 + 2 = 4 > 3$, the link (F,D) is rejected.
Recompute Tradeoff (F) = Cost(F,B) – 11 = 8 – 11 = -3

Next, consider Tradeoff (D). Similarly, the link (D, F) is rejected.
Recompute Tradeoff (D) = Cost(D,B) – 9 = 6 – 9 = -3,

Consider Tradeoff (E). Since $\sum W_i = W_E + W_B = 1 + 1 = 2 \leq 3$, the link (E,B) is accepted.



Iteration 3:
Tradeoff (B) = Cost(B,D) – 5 = 6 – 5 = 1, unchanged
Tradeoff (C) = Cost(C,D) – 6 = 7 – 6 = 1, unchanged
Tradeoff (D) = Cost(D,B) – 9 = 6 – 9 = -3
Tradeoff (E) = Cost(E,C) – 5 = 9 – 5 = 4
Tradeoff (F) = Cost(F,B) – 11 = 8 – 11 = -3
Tradeoff (G) = Cost(G,E) – 11 = 9 – 11 = -2, unchanged

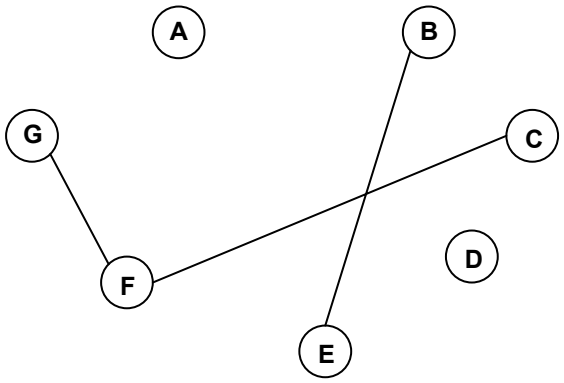
Tradeoff (D) is the lowest. Since $\sum W_i = W_B + W_E + W_D = 1 + 1 + 2 = 4 > 3$, the link (D,B) is rejected.
Recompute Tradeoff (D) = Cost(D,C) – 9 = 7 – 9 = -2

Consider Tradeoff (F). Since $\sum W_i = W_B + W_E + W_F + W_G = 1 + 1 + 1 + 1 = 4 > 3$, the link (F,B) is rejected.
Recompute Tradeoff (F) = Cost(F,C) – 11 = 8 – 11 = -3

Consider Tradeoff (G). The link (G,E) is rejected for the similar reason.
Recompute Tradeoff (G) = Cost(G,D) – 11 = 11 – 11 = 0

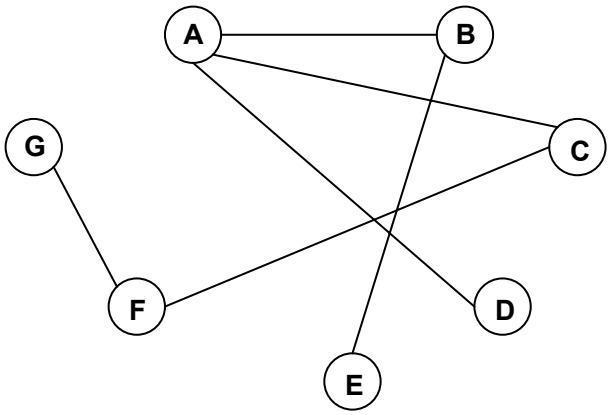
Iteration 4:
Tradeoff (B) = Cost(B,D) – 5 = 6 – 5 = 1, unchanged
Tradeoff (C) = Cost(C,D) – 6 = 7 – 6 = 1, unchanged
Tradeoff (D) = Cost(D,C) – 9 = 7 – 9 = -2
Tradeoff (E) = Cost(E,C) – 5 = 9 – 5 = 4, unchanged
Tradeoff (F) = Cost(F,C) – 11 = 8 – 11 = -3
Tradeoff (G) = Cost(G,D) – 11 = 11 – 11 = 0

Tradeoff (F) is the smallest. Since $\sum W_i = W_F + W_G + W_C = 1 + 1 + 1 = 3 \leq 3$, the link (F,C) is accepted.



Iteration 5:
Tradeoff (B) = Cost(B,D) – 5 = 6 – 5 = 1,
Tradeoff (C) = Cost(C,D) – 6 = 7 – 6 = 1,
Tradeoff (D) = Cost(D,C) – 9 = 7 – 9 = -2,
Tradeoff (E) = Cost(E,C) – 5 = 9 – 5 = 4,
Tradeoff (F) = Cost(F,N_j) – 6, no possible N_j left.
Tradeoff (G) = Cost(G,D) – 6 = 11 – 6 = 5

Tradeoff (D) is the lowest. However, this is infeasible since it violates the link weight constraint. The algorithm terminates, and thus we add link (B,A), (C,A), and (D,A) to complete the access network.


A
B
C
G
F
D
E