TSO Final Exam 24/Nov/2025 96

Adriana Concepcion Aguirre Dorantes. 2029675

46 + 50

+4.5
1- When we need a feasible solution in a reasonable time

+5.5 2.- When there is not an algorithm that solves it.

+5 3- Yes when there is already an algorithm that solves it

4 - Yes, thats the porpouse of a constructive heoristic, such as? it may
+5.5 not be the best solution but is a feasible one. Not always

5. It's to construct a solution adding one element to
+6 the solution at every iteration to form the final solution.

6.- It's a heuristic that given a solution to a Combinatorial
+6 Optimization problem attempts to improve it by making moves

7.- Its a move for local search that remove 2 non adjecent edges and reconect to form a move.

+7

```
Input: route                                   Output: route
best_distance ← distance (route)
improve ← True
while (improve) do
    improve ← False
    for j ← i + 1 to length(route)-1 do
      new_route ← Two OPT swap(route, i, j)
      new_distance < best distance then
       route ← new_route
       best_distance ← new distance
       improve ← TRUE
       end if
      endfor
    end while
```

+7
8.- Experiment with both making instances with diferent amount of input data and comparing the results of excecution time, coverage percentace, all excecuted in the same computer. ~~The heuristics~~

+5/7

a.- No because it contains a cycle C = (6-7-8)

b) Yes, is a 4-tree. Its weight is given by

+5 $w(X^2) = (w_{3,4} + w_{3,5} + w_{3,6} + w_{6,8})$

$w(X^2) = 17 + 6 + 20 + 16 = 59$

c) +8

$w(X_3) = (w_{5,9} + w_{6,8} + w_{6,9} + w_{7,8})$

$w(X_3) = 16 + 16 + 16 + 17 = 65$

$w(X_4) = (w_{4,6} + w_{4,7} + w_{5,6} + w_{6,7})$ → Not a feasible solution contains a cycle (4-6-7)

$w(X_5) = (w_{3,4} + w_{3,6} + w_{4,7} + w_{6,8})$

$w(X_5 = 17 + 20 + 8 + 16 = 61$

1.- $X^{(5)}$ → $w = 61$

2.- $X^{(3)}$ → $w = 65$

3.- $X^{(4)}$ → Not feasible

d)

1.- sort the w_{ij} start adding lowest w_{ij} to the solution

2.- while $K \neq 0$ in the solution look

+12

3.- then for every i and j add it to the solution.

for the lowest w_{ij} and

Input: $G = (V, E)$, $V = \{1, 2 \ldots n\}$, E = edges, w_{ij} for each E, K

K-tree [0]

Sort w_{ij} dearrising order

add E with lowest w_{ij} → k-tree[]

→ wK

→ K-1

while $K \neq 0$

among all the posible E pick the one with lowest w_{ij} only the edges that doesn't form a cycle

and add to → k_tree[]

w_K → w_K + w_i selected Edge

end While

K → K-1

WK → WT

+5

e) 1 - [1, 6, 6, 8, 9, 9, 9, 9, ...]

2 - K-tree starts with Edge 1, 2 → w_{ij} = 1 K = 4

3 - among posible eddes (2, 3 and 1, 4) pick 1, 4 → w_{ij} = 25

K_tree = [(1,2), (1,4)]

w = 26

K = 2

4 - among posible edges (2, 3), (4, 3), (4, 6) y (4, 7) pick 4, 7 → w = 8

Ktree = [(1, 2), (1, 4), (4, 7)

w = 34

K = 1

5 - among posible edges (2, 3), (4, 3), (4, 6), (7, 6), (7, 8)

pick (7, 6) → w = 6

K-tree = [(1, 2), (1, 4), (4, 7), (7, 6)]

W = 40

K = 0

W_T = 40

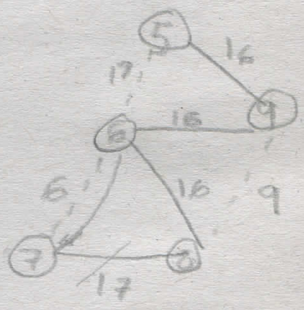
K_tree = [(1, 2), (1, 4), (4, 7), (7, 6)]

Yes, it was a better solution

+10

f) move: Remove one Edge and reconect to an approachable node in the solution

+5 g) X^3 = {(5, 9), (6, 8), (6, 9) (7, 8)}



First iteration

• Remove (5, 9); possible edges (5, 6)

(5, 6) → ΔW_T = -16 + 18 = 2

• Remove (9, 6) posible edges : 9, 8

ΔW_T = -16 + 9 = -7

• Remove (6, 8) posible edges : 6, 7

ΔW_T = -16 + 6 = -10

• Remove (7, 8) posible edges (7, 6)

ΔW_T = -17 + 6 = -11

Best Found : Remove (7, 8) and reconect. 7, 6

W_T = 16 + 16 + 16 + 6

W_T = 54

Yes, the solution improve