(OPTIONAL QUIZ) - IQ6 - Network Design Problem and TSP

Due Dec 9 at 3pm **Points** 100 **Questions** 4 **Time Limit** 10 Minutes
Allowed Attempts 3

Instructions

THIS QUIZ IS OPTIONAL. If you don't submit it, you won't be penalized. If you solve it and submit it, the quiz will be graded, and your lowest-score quiz will be dropped from your final grades.

This Individual Quiz has 4 multiple selection questions regarding Network Design Problem and TSP. Each Question is worth 25 points (for a total of 100 points).

Take the Quiz Again

Attempt History

	Attempt	Time	Score
KEPT	Attempt 2	2 minutes	100 out of 100
LATEST	Attempt 2	2 minutes	100 out of 100
	Attempt 1	9 minutes	75 out of 100

Correct answers are hidden.

Score for this attempt: **100** out of 100
Submitted Dec 8 at 4:05pm
This attempt took 2 minutes.

Question 1

25 / 25 pts

Consider the *Perseverance rover* TSP. Let $x_{ij} \in \{0,1\}$ be a binary variable that denotes if arc $(i,j) \in A$ is visited (where A is the set of links between each pair of quadrants), and let $0 \leq a_{ij} \leq 1 \; \forall \; (i,j) \in A$

be a parameter that represents how similiar each pair of quadrants are (where a value of 1 means perfect **similarity** and 0 means perfect **dissimilarity**). If the new goal is to maximize the total dissimilarities considering each pair of visits on the final route, which of the following expressions represents the objective function for the mathematical formulation of this problem?

A. $\max \sum_{(i,j)\in A} \; x_{ij} \cdot a_{ij}$
B. $\max \sum_{(i,j)\in A} \; x_{ij} \cdot (a_{ij} - 1)$
C. $\min \sum_{(i,j)\in A} \; x_{ij} \cdot a_{ij}$
D. $\min \sum_{(i,j)\in A} \; x_{ij} \cdot (a_{ij} - 1)$

- A)
- C) (selected)
- B)
- D)

Question 2

25 / 25 pts

Consider the *Perseverance rover* TSP. Let $x_{ij} \; \in \{0, 1\}$ be a binary variable that denotes if arc $(i, j) \in A$ is visited (where A is the set of links between each pair of quadrants), and let $0 \leq a_{ij} \leq 1 \; \forall \; (i, j) \in A$ be a parameter that represents how similiar each pair of quadrants are (where a value of 1 means perfect **similarity** and 0 means perfect **dissimilarity**). If there is now a requirement that at least one arc between a pair $(i, j) \in A$ whose similarity is greater than 0.5 must be active, which of the following expressions represents the constraint to be added to the mathematical formulation of this problem?

A. $\sum_{(i,j)\in A} \; x_{ij} \cdot \frac{a_{ij}}{0.5} = 1$

B. $\sum_{(i,j)\in A \mid a_{ij}>0.5} x_{ij} \geq 1$
C. $\sum_{(i,j)\in A} x_{ij} \cdot a_{ij} \cdot 0.5 \geq 1$
D. $\sum_{(i,j)\in A \mid a_{ij}\geq 0.5} x_{ij} \geq 1$

- (selected) B)
- A)
- D)
- C)

Question 3

25 / 25 pts

Consider the General formulation of the NDP:

$$Min\ z = \sum_{(i,j)\in A} c_{i,j}x_{ij} + \sum_{(i,j)\in A} f_{i,j}y_{ij}$$

$$\sum_{j:(i,\ j)\in A} x_{ij} - \sum_{j:(j,\ i)\in A} x_{ij} = b_i \qquad \forall i\ \in N$$

$$x_{ij} \leq u_{ij}y_{ij} \qquad \forall(i,j)\in A$$

$$x_{ij} \geq l_{ij}y_{ij} \qquad \forall(i,j)\in A$$

$$y_{ij} \in \{0,1\} \qquad \forall(i,j)\in A$$

If we wanted to make sure that the total number of arcs built/used is at most a number n, what would be the constraint(s) that should be added?

A. $\sum_{(i,j)\in A} f_{i,j}y_{ij} = n$

B. $\sum_{(i,j)\in A} x_{ij} \leq \sum_{(i,j)\in A} ny_{ij}$

C. $\sum_{(i,j)\in A} y_{ij} = n$

D. $\sum_{(i,j)\in A} y_{ij} \leq n$

- D)
- C)
- B)
- A)

Question 4

25 / 25 pts

Consider the General formulation of the NDP:

$$Min\ z = \sum_{(i,j)\in A} c_{i,j}x_{ij} + \sum_{(i,j)\in A} f_{i,j}y_{ij}$$

$$\sum_{j:(i,\ j)\in A} x_{ij} - \sum_{j:(j,\ i)\in A} x_{ij} = b_i \qquad \forall i\ \in N$$

$$x_{ij} \leq u_{ij}y_{ij} \qquad \forall(i,j)\in A$$

$$x_{ij} \geq l_{ij}y_{ij} \qquad \forall(i,j)\in A$$

$$y_{ij} \in \{0,1\} \qquad \forall(i,j)\in A$$

If we wanted have an LP model where whenever an arc (i,j) is built/used the arc associated with the opposite direction (i.e., arc (j,i)) is not built/used, what would be the constraint(s) that should be added?

A. $y_{ij}y_{ji} = 0 \qquad \forall(i,j)\in A : (j,i)\in A$

B. $y_{ij} + y_{ji} \leq 1 \qquad \forall(i,j)\in A : (j,i)\in A$

C. $y_{ij}(1 - y_{ji}) = 1 \qquad \forall(i,j)\in A : (j,i)\in A$

D. $y_{ij} \leq y_{ji} \qquad \forall(i,j)\in A : (j,i)\in A$

D)

A)

C)

B)

Quiz Score: **100** out of 100