Week 11: PYQs

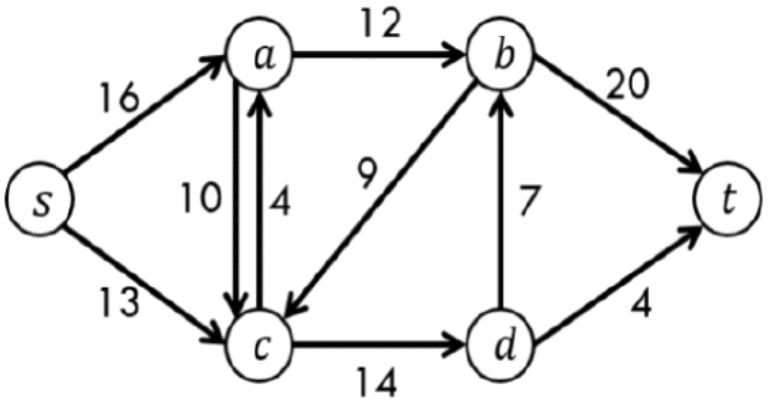
22 August 2024 01:16

1. Jan 24

Question Numbers : (159 to 160)

Question Label : Comprehension

Consider the network given below with source s and sink t, with the numbers on the edges denoting maximum capacity across a particular edge.



Based on the above data, answer the given subquestions.

Sub questions

Question Number : 159 Question Id : 640653815495 Question Type : MCQ Is Question Mandatory : No Calculator : None Response Time : N.A Think Time : N.A Minimum Instruction Time : 0

Correct Marks : 4

Question Label : Multiple Choice Question

The value of the maximum flow in the given network is__

Options :

[redacted]

[redacted]

1. Jan 24

Question Label : Multiple Choice Question

We want to increase the current maximum flow in a given network by capacity 2 from the vertex s to t. Select the edge, if we increase the capacity of that edge by 2, the maximum flow from s to t should be increased by 2.

Options :

6406532732043. ✖ (a, b)

6406532732044. ✖ (d, b)

6406532732045. ✖ (b, t)

6406532732046. ✔ (d, t)

2. Sep 23

A plant manufactures two types of products A and B and sells them at a profit of Rs. 5 per item on type A and Rs. 3 per item on type B. Each product is processed on two machines G and H. One item of type A requires one minute of processing time on G and two minutes on H; One item of type B requires one minute on G and one minute on H. The machine G is available for not more than 5 hours 40 minutes, while machine H is available for 7 hours 20 minutes during any working day. Let X_1 be the number of items produced of type A and X_2 be the number of items produced of type B.

The objective function to maximize the total profit $Z = 5X_1 + 3X_2$

Which of the following is/are **not a valid** constraint for the given problem?

Options :

[redacted] $X_1 + X_2 \leq 340$

[redacted] $X_1 + 2X_2 \leq 440$

[redacted] $X_1 \geq 0, X_2 \geq 0$

[redacted] $2X_1 + X_2 \leq 440$

[redacted] $X_1 + X_2 \geq 340$

3. Sep 23

In a school, there are n teachers and $2n$ subjects. Each subject taught by only one teacher and each teacher is required to teach exactly 2 subjects. However, teachers have their preferences for subjects they would like to teach, and the school wants to maximize overall satisfaction by assigning subjects to teachers based on their preferences.

The preferences of teachers are modeled as a directed graph G, where there exists an edge from a teacher node T_i to a subject node S_j in G if teacher T_i prefers teaching subject S_j. How can this problem be modelled as a network flow problem?

Options :

6406532323773. ✖ It can be modelled as a network flow problem, where the source node is connected to every teacher node in *G* with capacity of n, and every subject node in *G* is connected to the sink node with capacity of 2n.

6406532323774. ✖ It can be modelled as a network flow problem, where the source node is connected to every teacher node in G, and every subject node in *G* is connected to the sink node. All edges in the network flow graph have equal capacity.

6406532323775. ✔ It can be modelled as a network flow problem, where the source node is connected to every teacher node in *G* with capacity of 2, and every subject node in *G* is connected to the sink node with capacity of 1.

6406532323776. ✖ It can be modelled as a network flow problem, where the source node is connected to every teacher node in *G* with capacity of 1, and every subject node in *G* is connected to the sink node with capacity of 2.

4. May 23

Question Label : Multiple Choice Question

Let α be an NP-Complete problem, β and γ be two other problems. β is polynomial time reducible to α and α is polynomial time reducible to γ.
On the basis of the above information, what can be inferred ?

Options :

[redacted] β belongs to NP hard class

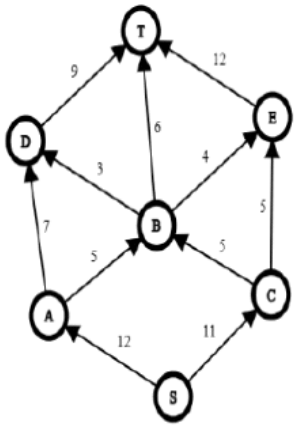
[redacted] β belongs to NP complete class

[redacted] γ belongs to NP hard class

[redacted] γ belongs to NP complete class

5. May 23

Consider the network given below with source s and sink t, with the numbers on the edges denoting maximum capacity across a particular edge



The value of the maximum flow in the given network is__

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

[redacted]

6. May 23

Question Label : Short Answer Question

Let G be a graph. The size of the minimum vertex cover of G is 12 and the size of the maximum independent set of G is 17. What are the number of the vertices in graph G?

[redacted]

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :

[redacted]

7. Jan 23

Given a flow network (G, s, t, c) and a flow f, how will you determine if f is maximum flow?

Options :

[redacted] If there is any edge that is not saturated to full capacity, then we can conclude that f is not a maximum flow.

[redacted] If the residual graph does not have any augmenting paths then f is a maximum flow.

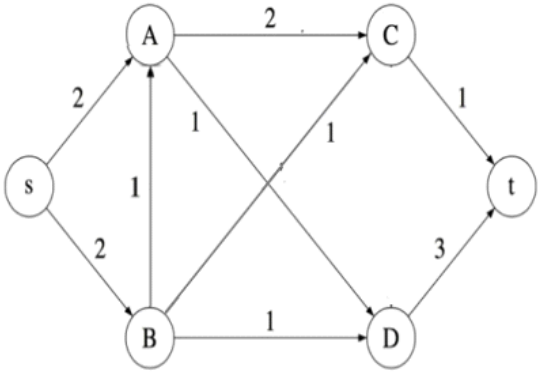
[redacted] If the value of the flow f is not the sum of the capacities of the edges coming out of the source s then f is not a maximum flow.

[redacted] If the value of the flow f is not the sum of the capacities of the edges coming into the sink t then f is not a maximum flow.

8. Jan 23

Question Label : Multiple Select Question

Consider the following network with source `s` and sink `t`, with the numbers on the edges denoting maximum capacity across a particular edge.



Suppose we want to increase the flow from the vertex s to t. An edge is called a bottleneck edge if the flow from s to t increases upon increasing the capacity of that edge. Select the bottleneck edge(s) from the below given options.

Note: If there are multiple bottleneck edges in the given options then select all of them.

Options :

6406531885510. ✖ (B,C)

6406531885511. ✔ (A,D)

6406531885512. ✔ (B,D)

6406531885513. ✖ (B, A)

9. Jan 23

A plant manufactures two types of products A and B and sells them at a profit of Rs. 5 per item on type A and Rs. 3 per item on type B. Each product is processed on two machines G and H. One item of type A requires one minute of processing time on G and two minutes on H; One item of type B requires one minute on G and one minute on H. The machine G is available for not more than 5 hours 40 minutes, while machine H is available for 7 hours 20 minutes during any working day. Let X_1 be the number of item produced of type A and X_2 be the number of item produced of type B.

Objective function to maximize the total profit $Z = 5X_1 + 3X_2$

Which of the following is/are **not a valid** constraint for the given problem?

Options :

[redacted] $X_1 + X_2 \leq 340$

[redacted] $X_1 + 2X_2 \leq 440$

[redacted] $X_1 \geq 0, X_2 \geq 0$

[redacted] $2X_1 + X_2 \leq 440$

[redacted] $X_1 + X_2 \geq 340$

10. Sep 22

Question Label : Multiple Choice Question

Which of the following statements are true ?

1. If a $NP - hard$ problem **A**, can be polynomial time reducible to another problem **B** then **B** is a NP class problem.
2. If a $NP - hard$ problem **A**, can be polynomial time reducible to another problem **B** then **B** is a $NP - complete$ class problem.
3. There exists polynomial time checking algorithm for all P class problems.

Options :

6406531513010. ✖ Only statement 1

6406531513011. ✖ Only statement 2

6406531513012. ✔ Only statement 3

6406531513013. ✖ Statement 2 and Statement 3

6406531513014. ✖ Statement 1 and Statement 2

11. Sep 22

A manufacturing company produces two types of products: `A` and `B`. Market tests and available resources indicate that the combined production level should not exceed 1200 products per week and the demand for the product `B` is at most half of that for product `A`. Further, the production level of product `A` can exceed three times the production of product `B` by at most 600 units. The company makes profit of Rs 12 and Rs 16 per product respectively on product `A` and B .

The above problem is to be formulated as a linear programming problem. Let x and y be the number of product `A` and product `B`, respectively. Objective function to maximize the number of products `z = 12x + 16y`.

Which of the following are **valid** constraints for the given problem?

Options :

[redacted] x + y <= 1200

[redacted] 2x - y >= 0

[redacted] 3x - y <= 600

[redacted] x - 2y >=0

[redacted] x - 3y <= 600

[redacted] x, y >= 0

12. May 22

Question Label : Multiple Choice Question

Consider the following statements and select the appropriate option regarding them

1. Checking algorithm for the Boolean satisfiability problem is intractable.
2. Given a problem α which is reduced in polynomial time from another problem β. If α is solvable in polynomial time, then β is also solvable within polynomial time.

Options :

6406531184519. ✖ Only statement 1 is correct

6406531184520. ✔ Only statement 2 is correct

6406531184521. ✖ Both the statements are correct

6406531184522. ✖ Both the statements are wrong

13. May 22

Consider the following problem statement.

There are 15 saree printing machines in a printing press company. Each machine produces 500 sarees and consumes electricity worth Rs 15000 every month. A machine can be overloaded to print more sarees, but it should not be loaded more than 10% of its usual production capacity. Also, when the machine is overloaded, it consumes 20% more electricity. Demand of saree for the i^{th} month is represented with variables $d_i | 1 <= i <= 12$. In order to balance demand and production to optimize profit, the company can switch off a machine for a month, but during that month a maintenance charge of Rs 60 is required for that machine. Similarly, in order to switch on a machine that was switched off previously, a startup cost of Rs 40 is required for that machine. The press might produce surplus sarees, the cost to store these surplus sarees is Rs 30 per saree.

Assume we use the following notations for representing the variables required to model this into a LPP problem:

1. m_i : machines running in month i
2. s_i : sarees made in month i
3. o_i : sarees made in overloaded state in month i
4. n_i : machines started in the start of month i
5. x_i : machines switched off in the start of month i
6. g_i : number of surplus sarees at the end of month i
7. d_i : demand of saree for month i

Identify the correct constraints pertinent to the above problem exclusively from the below options.

Options :

[redacted] $s_i = 500m_i + g_i$

[redacted] $m_i = m_{i-1} + n_i - x_i$

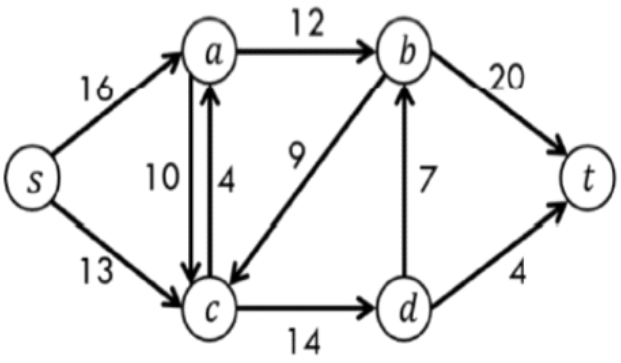
[redacted] $g_i = s_i - d_i$

[redacted] $m_i <= 15$

[redacted] $o_i <= 50m_i$

14. May 22

Consider the following network:



Consider the network given above with source s and sink t, with the numbers on the edges denoting maximum capacity across a particular edge. The value of the maximum flow in the given network is_____.

Response Type : Numeric

Evaluation Required For SA : Yes

Show Word Count : Yes

Answers Type : Equal

Text Areas : PlainText

Possible Answers :