

Marks: 30

Time: 1 Hour 15 Minutes+
15 Minutes Script Upload Time

Professionalism	Excellence	Respect
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Answer all the questions. The weight of each question is mentioned at the right side

1. a) Write the dual of the LPP: 3

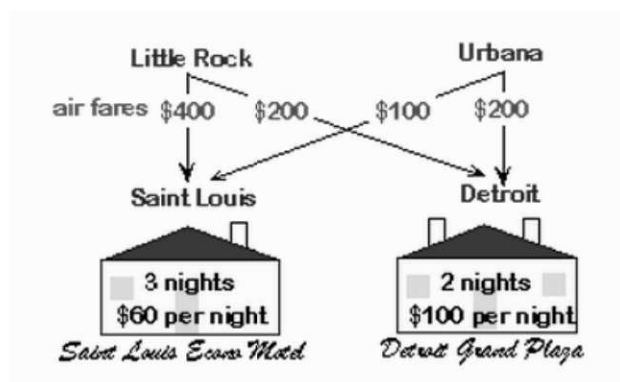
$$\text{Maximize } z = 5x_1 - 2x_2$$

$$\text{Subject to: } -x_1 + x_2 \leq -2$$

$$2x_1 + 3x_2 \leq 5$$

$$x_1, x_2 \geq 0$$

- b) Your software company has launched the latest version of its web browser, "Java Cruise 4.0." As sales manager, you are planning to promote Java Cruise 4.0 by sending sales forces to software conventions running concurrently in Saint Louis and Detroit. You have 6 representatives available at each of your Little Rock, Ark. and Urbana, Ill. branches, and you would like to send at least 5 to the Saint Louis convention and at least 4 to the Detroit convention. The Saint Louis convention will last for three days, while the Detroit convention will last for two days. Air fares (per person) and hotel accommodation costs (per person) are shown in the following figure:



Formulate a mathematical model of the situation that may be used to minimize the total (air travel and accommodation) cost.

2. Provide a dynamic programming formulation of the following problem. 6

Making Change:

Input: n denominations of coins of values $=v_1 < v_2 < v_3 < \dots < v_n$

Goal: Make change for amount of money C . Use as few coins as possible.

What is the runtime complexity of your solution?

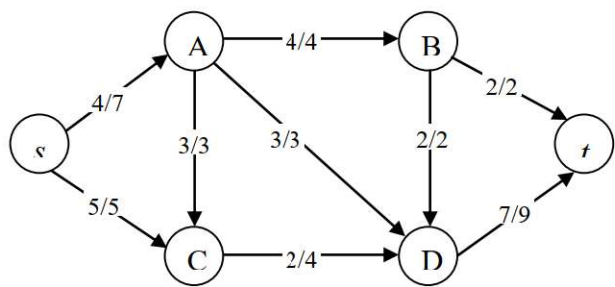
3. Determine an LCS of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$. 6

4. a) Let G be a graph with three sources (s_1, s_2, s_3), two sinks (t_1, t_2) and a positive integer capacity on each edge. Explain how it can be converted to a standard maximum-flow problem. 2

- b)

Consider the following graph where the label x/y for each edge represents current flow and edge capacities, s and t represents source vertex and sink respectively. Draw the residual network for this graph. Find the maximum flow and minimum cut for this graph.

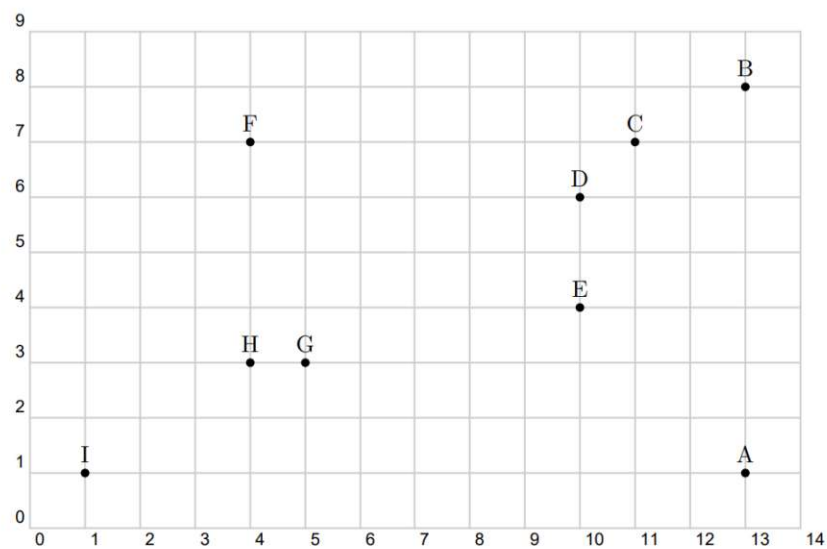
4



5. a)

Consider the following set of points. Find the convex hull of these points using the Graham scan algorithm starting from A. Show all of your work and list the points in the order they appear on the convex hull.

3



- b)

Define the following: (i) Polynomial time problems, (ii) NP Hard Problems, (iii) NP-Completeness.

3

GOOD LUCK!

(Please return this question paper with the answer script)