MGT 2251 Management Science

Exam 2 October 8 2015

REVIEW SESSION

Duration: 80 minutes

Last Name (Print):_____

First Name (Print):_____

ID #:_____

Read each question carefully before you answer. Work at a steady pace.
Good Luck!

My signature *certifies* that I have taken this exam in accordance with the Georgia Tech Honor Code.

Signature_____

I. Multiple-Choice Questions from Q1 to Q12

1. A technique that allows a researcher to determine the greatest amount of material that can move through a network is called
   A) maximal-flow.
   B) maximal-spanning.
   C) shortest-route.
   D) maximal-tree.

2. Which of the following is false?
   A) Maximal-flow technique can be used to study traffic congestion problem between two points on a road network.
   B) Internet services providers (such as Comcast) typically employ minimal-spanning tree technique to provide cable/internet connections to houses.
   C) Package delivery companies (such as UPS) use shortest-route techniques to deliver packages.
   D) Water supply companies would employ the shortest-route technique to lay out the pipes connecting individual houses.

3. When formulating a transportation problem with 2 sources and 4 destinations as a linear programming problem, which of the following statements is true?
   A) There are typically 6 decision variables and 8 constraints (excluding non-negativity constraints).
   B) There are typically 6 decision variables and 4 constraints (excluding non-negativity constraints).
   C) There are typically 8 decision variables and 6 constraints (excluding non-negativity constraints).
   D) There are typically 4 decision variables and 6 constraints (excluding non-negativity constraints).

4. The minimal-spanning technique would best be used
   A) to assign workers to jobs in the cheapest manner.
   B) to determine LAN network wiring within a building.
   C) to minimize traffic flow on a busy highway.
   D) to determine the number of units to ship from each source to each destination.

5. The maximal-flow technique would best be used
   A) to assign workers to jobs in the cheapest manner.
   B) to determine the number of units to ship from each source to each destination.
   C) to determine LAN network wiring within a building.
   D) to maximize traffic flow on a busy highway.

6. The original or beginning node in a network is called a(n)
   A) arc.
   B) branch.
   C) source.
   D) mouth.
   E) sink.

7. The first step of the minimal-spanning tree technique is to
   A) select the node with the highest distance between it and any other node.
   B) select the node that is closest to the origin.
   C) select any arc that connects two nodes.

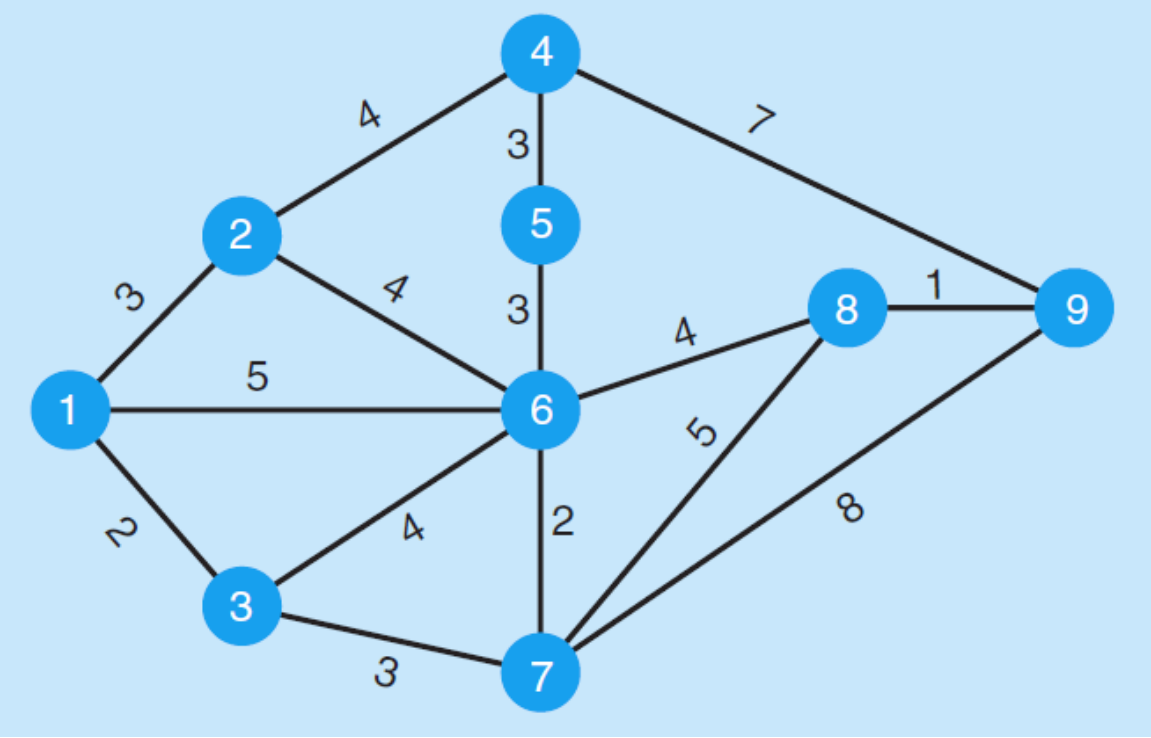
D) select any node.

8. In a minimal-spanning tree problem, the optimal solution has been found when
   A) all nodes have been connected and are a part of the tree.
   B) the start node and the finish node are connected by a continuous path.
   C) the flow from the start node is equal to the flow into the finish node.
   D) all arcs have been selected to be a part of the tree.

9. The shortest-route technique would best be used to
   A) assign workers to jobs in the cheapest manner.
   B) determine the number of units to ship from each source to each destination.
   C) determine the amount of LAN network wiring within a building.
   D) determine the path for a truck making frequent but repeatable drops.

10. In solving a facility location problem in which there are two possible locations being considered, the transportation algorithm may be used. In doing this,
   A) two sources would be added to the existing rows and the enlarged problem would be solved.
   B) two separate transportation problems would be solved.
   C) costs of zero would be used for each of the new facilities.
   D) the problem would be a transshipment problem.

For questions 11 to 12, use the following figure (Minimal-Spanning Tree Problem).



11. Given the distances between different nodes, what is the total length of pipes required to connect all the nodes?
   A) 18
   B) 19

C) 21
D) 22

12. Given the distances between different nodes, which of the following arcs is not used to connect the nodes?
A) 3-6
B) 1-2
C) 6-8
D) 1-3

II. Problem Solving

13. The air traffic system passing through the United States can handle aircraft flows with capacities in hundreds of planes per hour as shown in the table below. United States is trying to find the maximum number of planes that can flow through City 5 to City 1.

From/To	***1***	***2***	***3***	***4***	***5***
City 1	-	2	-	4	-
City 2	1	-	2	3	3
City 3	2	2	-	5	2
City 4	-	-	-	-	3
City 5	-	2	2	1	-

A) What type of network problem this is?
B) Draw the network presentation of the problem. (Make sure you clearly show the nodes, arcs and the values on the arcs.
C) Formulate this problem into a linear programming model (including decision variables, objective function, and constraints). Don't forget to label the constraints

14. A company has 4 machines available for assignment to 4 tasks. Any machine can be assigned to any task, and each task requires processing by one machine. The time required to set up each machine for the processing of each task is given in the table below.

Time (Hours)

	Task 1	Task 2	Task 3	Task 4
Machine 1	13	4	7	6
Machine 2	1	11	5	4
Machine 3	6	7	2	8
Machine 4	1	3	5	9

The company wants to minimize the total setup time needed for the processing of all four tasks.
A) Identify the type network of problem for AC.
B) Draw the network diagram including all the nodes and all the possible connections.
C) Formulate this problem into a linear programming model (including decision variables, objective function, and constraints) Don't forget to label the constraints

15. Neki Sports Company manufactures treadmills in factories located in Pittsburgh and Kansas City. These are shipped to regional distribution centers in Chicago, Phoenix, and Philadelphia. Ultimately they are delivered to supply houses in New York and Los Angeles. The available supplies at the factories, demands at the final destinations, and shipping costs are illustrated in the table below. Neki's goal is to minimize the total costs.

From/To	***Chicago***	***Phoenix***	***Philadelphia***	***New York***	***Los Angeles***	**Supply**
Pittsburgh	$4	$8	$2	-	-	**1500**
Kansas City	$3	$6	$5	-	-	**1000**
Chicago	-	-	-	5	7	**-**
Phoenix	-	-	-	8	3	**-**

Philadelphia	-	-	-	2	9	**-**
Demand	**-**	**-**	**-**	**1200**	**800**	**-**

A) Identify the type of network problem for Neki Sports.

B) Draw the network diagram including all the nodes and all the possible connections. Also include all supply and demand quantities and the costs on the diagram.

C) Formulate this problem into a linear programming model (including decision variables, objective function, and constraints) Don't forget to label the constraints

16. Don Levine Corporation has three existing facilities in Decatur, Minneapolis, and Carbondale. From these facilities, the company ships goods to Atlanta, Miami and Tampa. The company is considering adding an additional plant to either St. Louis or Chicago. The transportation costs per unit for <u>existing plants</u> are shown in the table below.

From/To	***Atlanta***	***Miami***	***Tampa***	**Supply**
Decatur	$20	$25	$22	**300**
Minneapolis	17	27	25	**200**
Carbondale	21	20	22	**150**
Demand	**250**	**200**	**350**	

The transportation costs per unit for <u>proposed plants</u> are shown in the table below.

From/To	***Atlanta***	***Miami***	***Tampa***	**Supply**
St. Louis	$29	$30	$30	**150**
Chicago	27	28	31	**170**

A) Identify the type of network problem for Don Levine Corp.

Suppose that Don Levine Corp. is first considering the case where St. Louis location is added. Answer parts B and C according to this assumption.

B) Draw the network diagram that includes St. Louis location, including all the nodes and all the possible connections. Also include all supply and demand quantities and the costs on the diagram.

C) Formulate this problem into a linear programming model (including decision variables, objective function, and constraints. Don't forget to label the constraints.)

Next, suppose that Don Levine Corp. is considering the case where Chicago location is added. Answer parts D, E and F according to this assumption.

D) Which decision variable changes in this case compared to the formulation you wrote in part C? Why?

E) What changes in the objective function in this case compared to the formulation you wrote in part C? Why?

F) Which constraint(s) change(s) in the objective function in this case compared to the formulation you wrote in part C? Why?