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← MNS407 Management Science, Fall 2024

# 407 Week 4: Final (Quiz)

INSTRUCTOR

**Vahid Keyhani**

National University, La Jolla CA

## Current Score

QUESTION	1	2	3	4	5	6	7	8	9	10	11	12	13
POINTS	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46	-/1.46



### TOTAL SCORE

**-/22**   **0.0%**

## Due Date

**SAT, NOV 23, 2024**  
11:59 PM PST

[Request Extension](#)

## Instructions



This final is comprehensive, it covers material presented during the last week (chapter 9) and also questions from prior weeks. You have one attempt to submit your answers.  
The way that you write your answers matters! Syntax matters! Make sure you had successfully completed the "Getting Started in Web Assign for Mathematics" training quiz in Module 1. This training quiz makes it clear how to provide answers that the WebAssign system understands for homework, quizzes, and the final.

## Assignment Submission & Scoring

### Assignment Submission

For this assignment, you submit answers by question parts. The number of submissions remaining for each question part only changes if you submit or change the answer.

### Assignment Scoring

Your last submission is used for your score.

1. [-/1.46 Points]

DETAILS

MY NOTES

CAMMIMS16 9.TB.059.

PRACTICE ANOTHER

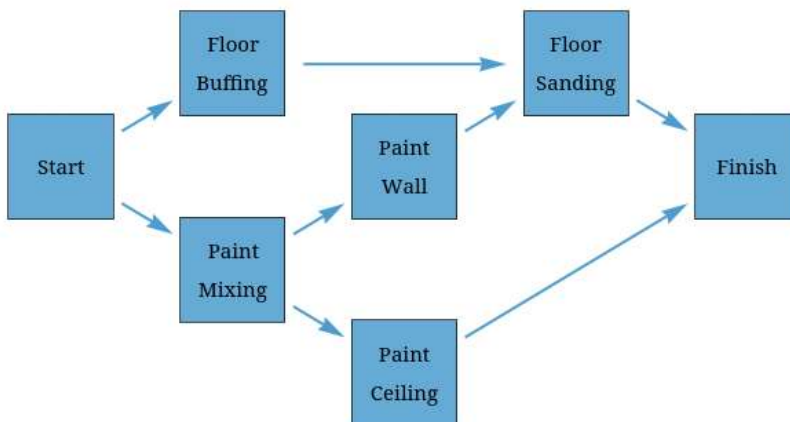
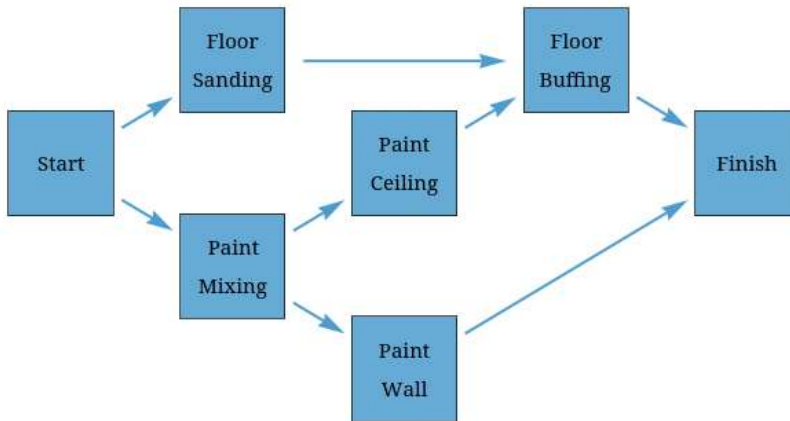
You may need to use the appropriate [technology](#) to answer this question.

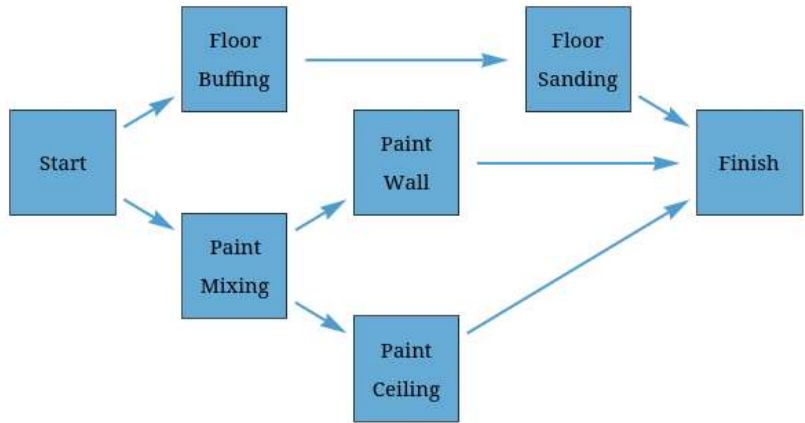
A project consists of five activities as shown in the following table.

Activity	Optimistic Time (hr)	Most Probable Time (hr)	Pessimistic Time (hr)
Floor sanding	4	5	6
Floor buffing	4	5	6
Paint mixing	0.5	1	1.5
Wall painting	3	4	11
Ceiling painting	3	7.5	9

Naturally, the paint mixing precedes the painting activities. Also, both ceiling painting and floor sanding must be done prior to floor buffing.

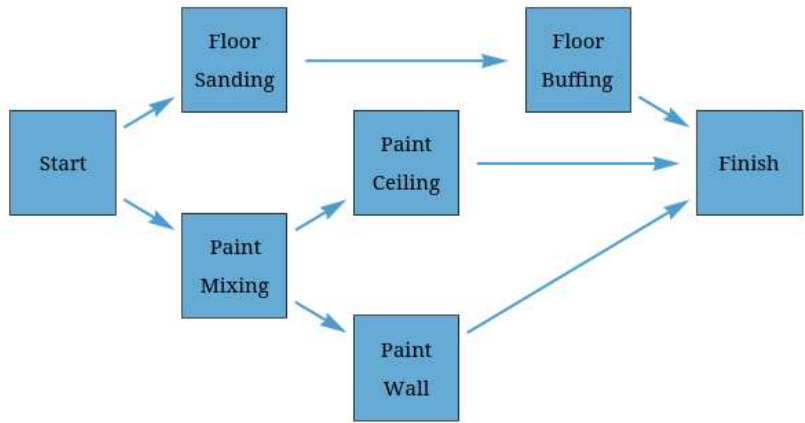
(a) Construct the PERT/CPM network for this problem.





○

ⓘ



○

ⓘ

(b) What is the expected completion time (in hours) of this project?

hr

(c) What is the probability that the project can be completed within **fourteen** hours? (Round your answer to four decimal places.)

**Show My Work**

(Optional) ⓘ

2. [-/1.46 Points]

DETAILS

MY NOTES

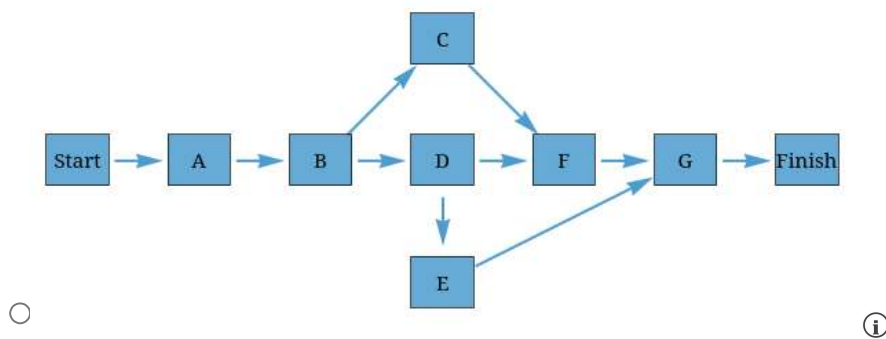
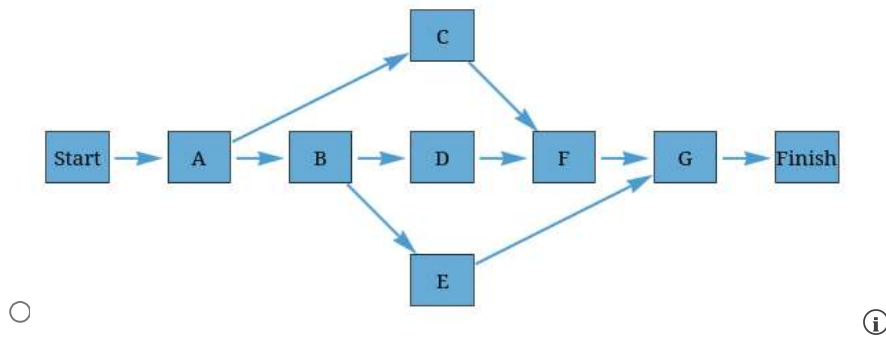
CAMMIMS16 9.TB.047.

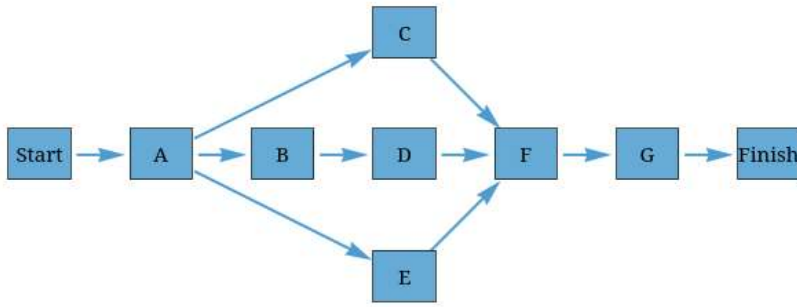
PRACTICE ANOTHER

Consider the following table of activities.

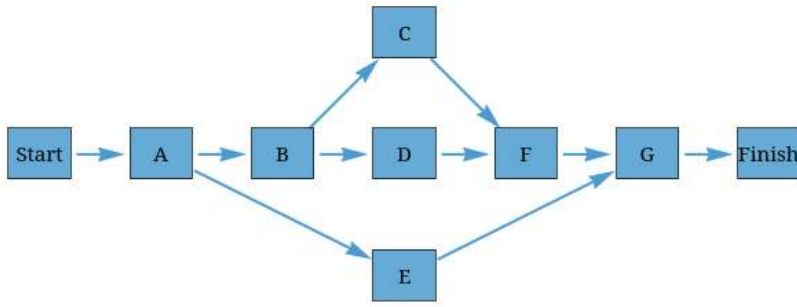
Activity	Immediate Predecessor
A	
B	A
C	B
D	B
E	A
F	C, D
G	E, F

From the schedule of activities shown in the following table, draw the PERT/CPM network.





[i](#)



[i](#)

**Show My Work**

(Optional) [?](#)

3. [-/1.46 Points]

[DETAILS](#)

[MY NOTES](#)

CAMMIMS16 4.TB.035.

[PRACTICE ANOTHER](#)

A grocery store manager must decide how to best present a limited supply of popcorn and soda to its customers. Popcorn can be sold by itself for a profit of \$1.70 per tin. Soda can likewise be sold at a profit of \$2.70 per liter. To increase appeal to customers, one tin of popcorn and a liter of soda can be packaged together and sold for a profit of \$3.10 per bundle. The manager has at most 110 tins of popcorn and 160 liters of soda to make available each day. The manager has decided to stock at least 65 individual tins of popcorn per day (excluding popcorn bundled with soda). Demand for individual liters of soda is at most 150 liters per day (excluding soda bundled with popcorn). The manager wishes to determine how much of each product to stock each day.

Which of the following is the objective function for the grocer's problem? (Let  $P$  be the number of individual tins of popcorn stocked each day. Let  $S$  be the number of individual sodas stocked each. Let  $B$  be the number of bundles stocked. Assume that, within the limitations established by the constraints, the store can sell all the products it stocks.)

- Min  $1.7P + 2.7S + 3.1B$
- Max  $2.7P + 1.7S + 3.1B$
- Min  $2.7P + 3.1S + 1.7B$
- Max  $1.7P + 2.7S + 3.1B$

**Show My Work**

(Optional) [?](#)

4. [-/1.46 Points]

DETAILS

MY NOTES

ASWMSCI15 13.E.005.

PRACTICE ANOTHER

The following payoff table shows profit for a decision analysis problem with two decision alternatives and three states of nature.


Decision Alternative	States of Nature		
	$s_1$	$s_2$	$s_3$
$d_1$	260	110	35
$d_2$	110	110	85

Suppose that the decision maker obtained the probabilities  $P(s_1) = 0.65$ ,  $P(s_2) = 0.15$ , and  $P(s_3) = 0.20$ . Use the expected value approach to determine the optimal decision.

$$EV(d_1) = \text{[input box]}$$

$$EV(d_2) = \text{[input box]}$$

The optimal decision is  .

**Need Help?**[Read It](#)**Show My Work**(Optional) 

5. [-/1.46 Points]

DETAILS

MY NOTES

CAMMIMS16 9.TB.050.

PRACTICE ANOTHER

A senior MIS design class project team has developed a schedule of activities for their project using their best estimate of completion times as shown in the following table.

Activity	Time	Immediate Predecessor
A. find client	5	
B. write prospectus	3	A
C. obtain approval from client and professor	5	B
D. complete programming	13	C
E. do industry background research	10	
F. write final paper	6	D, E
G. write oral report	5	D, E

Both written and oral reports are required. Draw the project network. Can they complete the project in the 44 class days remaining until the end of the semester?

---Select--- ▾ , they can complete it in time since the project is expected to be completed in  days.

### Show My Work

(Optional) ?

6. [-/1.46 Points]

DETAILS

MY NOTES

ASWMSCI15 2.TB.010.

PRACTICE ANOTHER

The point (5, 4) is feasible for the constraint  $2x_1 + 6x_2 \leq 30$ .

True

False

Need Help?

Read It

### Show My Work

(Optional) ?

7. [-/1.46 Points]

DETAILS

MY NOTES

CMMIMS16 3.TB.040.

PRACTICE ANOTHER

In the following linear programming problem, how much would you be willing to pay for an additional 7 units of Resource W? (Note: This problem requires Solver.)

$$\text{Maximize } P = 3x + 15y$$


Subject to:

$$2x + 4y \leq 12 \text{ (Resource W)}$$

$$5x + 2y \leq 10 \text{ (Resource Z)}$$

$$x, y \geq 0$$

- 0
- 26.25
- 30
- 33.75

**Show My Work**(Optional) 

8. [-/1.46 Points]

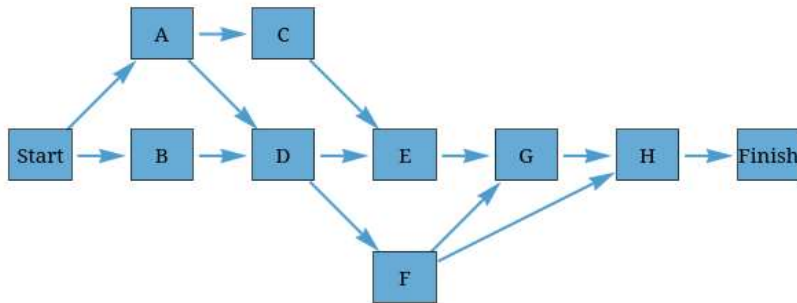
DETAILS

MY NOTES

CAMMIMS16 9.TB.048.

PRACTICE ANOTHER

Consider the following PERT/CPM network.




From the PERT/CPM network shown in the figure, create a list of activities and their predecessors. (Enter your answers as comma-separated lists. If an activity does not have immediate predecessors, enter NONE.)

Activity	Immediate Predecessor
A	<input type="text"/> <input type="text"/>
B	<input type="text"/> <input type="text"/>
C	<input type="text"/> <input type="text"/>
D	<input type="text"/> <input type="text"/>
E	<input type="text"/> <input type="text"/>
F	<input type="text"/>

	<input type="text"/>
G	<input type="text"/> <input type="text"/>
H	<input type="text"/> <input type="text"/>

**Show My Work**

(Optional) 

9. [-/1.46 Points]

DETAILS

MY NOTES

CAMMIMS16 13.TB.067.

PRACTICE ANOTHER

Lakewood Fashions must decide how many lots of assorted ski wear to order for its three stores. Information on pricing, sales, and inventory costs has led to the following payoff table, in thousands.

	Demand		
Order size	Low	Medium	High
1 lot	11	14	14
2 lots	9	24	36
3 lots	6	36	65

(a) Show a regret table.

	Demand			
Order size	Low	Medium	High	Maximum Regret
1 lot	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2 lots	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3 lots	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

(b) What decision should be made by the optimist?

- 1 lot  
 2 lots  
 3 lots

(c) What decision should be made by the conservative?

- 1 lot  
 2 lots  
 3 lots

(d) What decision should be made using minimax regret?

- 1 lot  
 2 lots  
 3 lots

**Show My Work**

(Optional) 

10. [-/1.46 Points]

DETAILS

MY NOTES

CMMIMS16 2.TB.045.

PRACTICE ANOTHER

Consider the following linear programming problem:

$$\text{Max } 7X + 6Y$$

s.t.

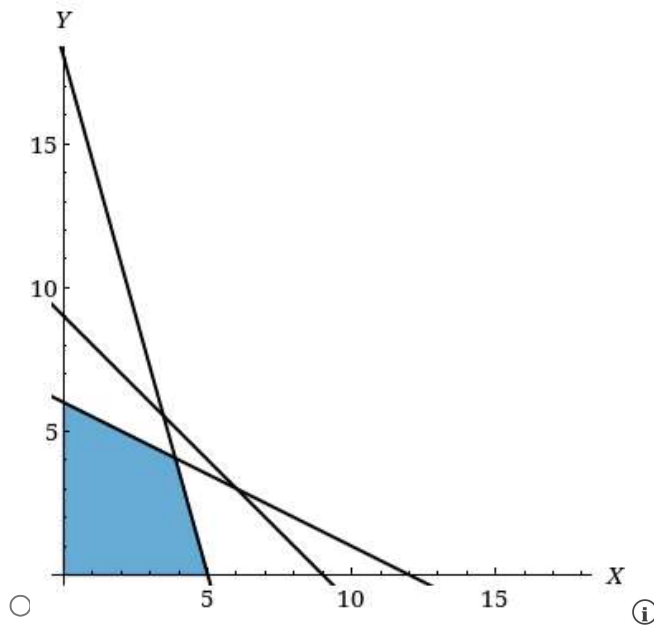
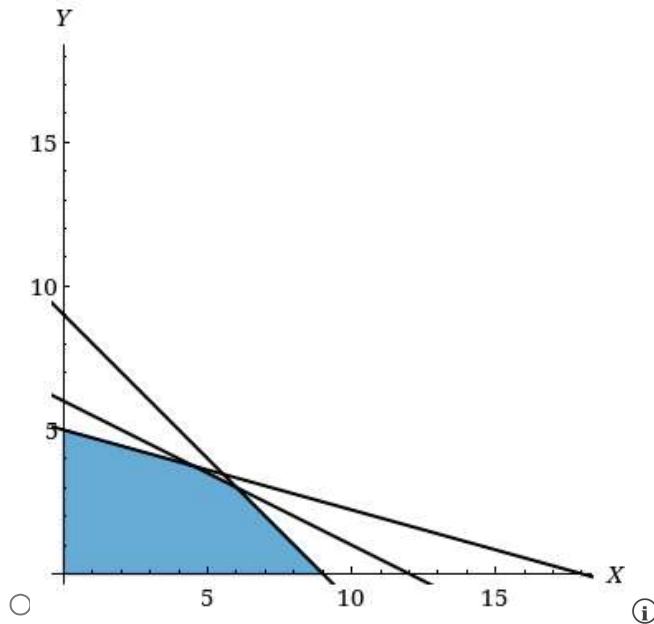
$$18X + 5Y \leq 90$$

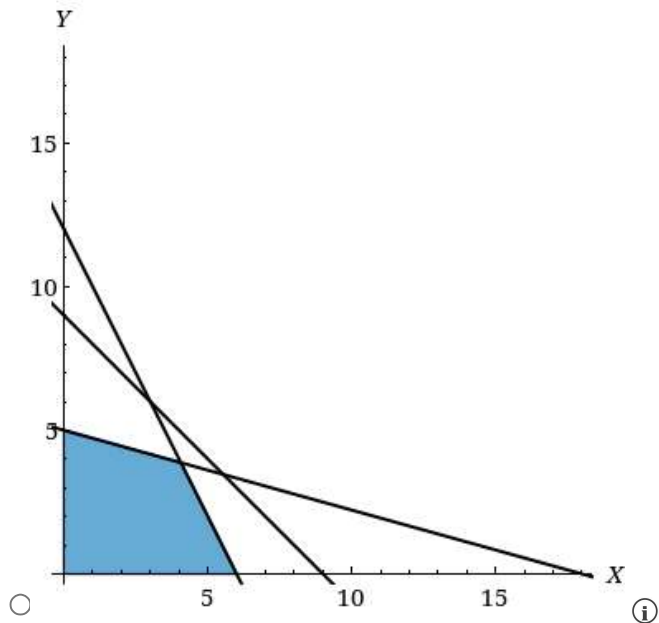
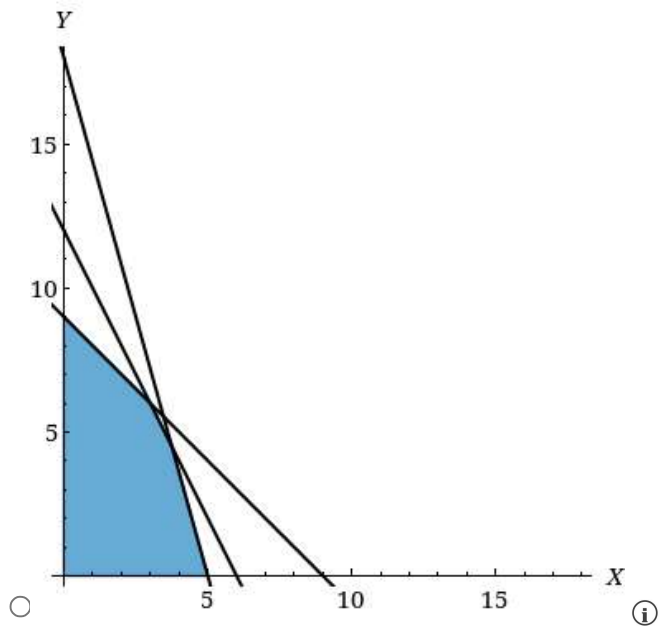
$$12X + 6Y \leq 72$$

$$X + Y \leq 9$$

$$X, Y \geq 0$$

(a) Use a graph to show each constraint and the feasible region.





(b) Identify the optimal solution point on your graph. What are the values of X and Y at the optimal solution?

$(X, Y) = ($   
  
  
 $)$

(c) What is the optimal value of the objective function?

**Show My Work**

(Optional)

11. [-/1.46 Points]

DETAILS

MY NOTES

CAMMIMS16 6.TB.045.

PRACTICE ANOTHER

A firm has 4 plants that produce widgets. Plants A, B, and C can each produce 120 widgets per day. Plant D can produce 60 widgets per day. Each day, the widgets produced in the plants must be shipped to satisfy the demand of 3 customers. Customer 1 requires 55 units per day, customer 2 requires 120 units per day, and customer 3 requires 245 units per day. The shipping costs for each possible route are shown in the table below:

Shipping Costs per unit at Plant	Customer 1	Customer 2	Customer 3
<b>A</b>	\$15	\$20	\$25
<b>B</b>	\$40	\$35	\$20
<b>C</b>	\$20	\$30	\$40
<b>D</b>	\$25	\$35	\$15

The firm needs to satisfy all demand each day but would like to minimize the total costs.

Select the constraint that models customer demand.

- $x_{A1} + x_{B1} + x_{C1} + x_{D1} = 55$   
  $x_{A1} + x_{A2} + x_{A3} \leq 120$   
  $x_{C1} + x_{C2} + x_{C3} \leq 120$   
  $x_{B1} + x_{B2} + x_{B3} \leq 120$

### Show My Work

(Optional) 

12. [-/1.46 Points]

DETAILS

MY NOTES

ASWMSCI15 4.TB.023.

PRACTICE ANOTHER

An LP model for a marketing research application uses the variable  $HD$  to represent the number of homeowners interviewed during the day. The objective function minimizes the cost of interviewing this and other categories. There is a constraint that  $HD \geq 160$ . The solution indicates that interviewing another homeowner during the day will increase costs by \$20.00. What does this tell you about the  $HD$  variable?

- The objective function coefficient of  $HD$  is  $-20$ .
- The objective function coefficient of  $HD$  is  $20$ .
- The dual price for the  $HD$  constraint is  $-20$ .
- The dual price for the  $HD$  constraint is  $20$ .

Need Help?

Read It

**Show My Work**

(Optional) ?

13. [-/1.46 Points]

DETAILS

MY NOTES

Cammims16 13.TB.035.

PRACTICE ANOTHER

What does sensitivity analysis consider?

- how changes in various aspects of the problem affect the recommended decision alternative
- how changes in the number of states of nature can impact the recommended decision
- how sensitive the decision maker is to risk
- None of these are correct.

**Show My Work**

(Optional) ?

14. [-/1.56 Points]

DETAILS

MY NOTES

CAMMIMS16 3.E.007.

PRACTICE ANOTHER

Investment Advisors, Inc., is a brokerage firm that manages stock portfolios for a number of clients. A particular portfolio consists of  $U$  shares of U.S. Oil and  $H$  shares of Huber Steel. The annual return for U.S. Oil is \$3 per share and the annual return for Huber Steel is \$5 per share. U.S. Oil sells for \$25 per share and Huber Steel sells for \$50 per share. The portfolio has \$80,000 to be invested. The portfolio risk index (0.50 per share of U.S. Oil and 0.25 per share for Huber Steel) has a maximum of 700. In addition, the portfolio is limited to a maximum of 1,000 shares of U.S. Oil. The linear programming formulation that will maximize the total annual return of the portfolio is as follows.

$$\begin{aligned}
 &\text{Max } 3U + 5H && \text{Maximize total annual return} \\
 &\text{s.t.} \\
 &25U + 50H \leq 80,000 && \text{Funds available} \\
 &0.50U + 0.25H \leq 700 && \text{Risk maximum} \\
 &1U \leq 1,000 && \text{U.S. Oil maximum} \\
 &U, H \geq 0
 \end{aligned}$$

The computer output is shown below.

Optimal Objective Value = 8400.00000

Variable	Value	Reduced Cost
U	800.00000	0.00000
H	1200.00000	0.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	0.09333
2	0.00000	1.33333
3	200.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
U	3.00000	7.00000	0.50000
H	5.00000	1.00000	3.50000

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	80000.00000	60000.00000	15000.00000
2	700.00000	75.00000	300.00000
3	1000.00000	Infinite	200.00000

(a) What is the optimal solution, and what is the value of the total annual return (in \$)?

$U$    
 $H$    
 estimated annual return \$

(b) Which constraints are binding? What is your interpretation of these constraints in terms of the problem? (Select all that apply.)

- Constraint 1. All funds available are being utilized.
- Constraint 2. The maximum permissible risk is being incurred.
- Constraint 3. All available shares of U.S. Oil are being purchased.
- None of the constraints are binding.

(c) What are the dual values for the constraints? Interpret each. (Round your answers to two decimal places.)

constraint 1

- Constraint 1 has a dual value of 1.33. If an additional dollar is added to the available funds, the total annual return is predicted to increase by \$1.33.
- Constraint 1 has a dual value of 5. If an additional dollar is added to the available funds, the total annual return is predicted to increase by \$5.
- Constraint 1 has a slack of \$200. Additional dollars added to the available funds will not improve the total annual return.
- Constraint 1 has a dual value of 0.09. If an additional dollar is added to the available funds, the total annual return is predicted to increase by \$0.09.
- Constraint 1 has a dual value of 3. If an additional dollar is added to the available funds, the total annual return is predicted to increase by \$3.

constraint 2

- Constraint 2 has a dual value of 1.33. If the risk index is increased by 1, the total annual return is predicted to increase by \$1.33.
- Constraint 2 has a dual value of 5. If the risk index is increased by 1, the total annual return is predicted to increase by \$5.
- Constraint 2 has a slack of 200. Allowing additional risk will not improve the total annual return.
- Constraint 2 has a dual value of 0.09. If the risk index is increased by 1, the total annual return is predicted to increase by \$0.09.
- Constraint 2 has a dual value of 3. If the risk index is increased by 1, the total annual return is predicted to increase by \$3.


constraint 3

- Constraint 3 has a dual value of 1.33. If the maximum number of shares of U.S. Oil is increased by 1, the total annual return is predicted to increase by \$1.33.
- Constraint 3 has a dual value of 5. If the maximum number of shares of U.S. Oil is increased by 1, the total annual return is predicted to increase by \$5.
- Constraint 3 has a slack of 200 shares. Raising the maximum number of shares of U.S. Oil will not improve the total annual return.
- Constraint 3 has a dual value of 0.09. If the maximum number of shares of U.S. Oil is increased by 1, the total annual return is predicted to increase by \$0.09.
- Constraint 3 has a dual value of 3. If the maximum number of shares of U.S. Oil is increased by 1, the total annual return is predicted to increase by \$3.

(d) Would it be beneficial to increase the maximum amount invested in U.S. Oil? Why or why not?

- Yes, each additional share increases the profit by \$0.09.
- Yes, each additional share increases the profit by \$1.33.
- Yes, each additional share increases the profit by \$200.00.
- No, increasing the maximum shares does not affect the optimal value.

## Show My Work

(Optional) 

15. [-/1.46 Points]

DETAILS

MY NOTES

CMMIMS16 6.TB.050.

PRACTICE ANOTHER

Draw the network for this transportation problem. (Let  $x_{ij}$  represent the flow from node  $i$  to node  $j$ .)

$$\text{Min } 2x_{13} + 4x_{14} + 6x_{15} + 10x_{23} + 13x_{24} + 11x_{25}$$

s.t.

$$x_{13} + x_{14} + x_{15} \leq 500$$

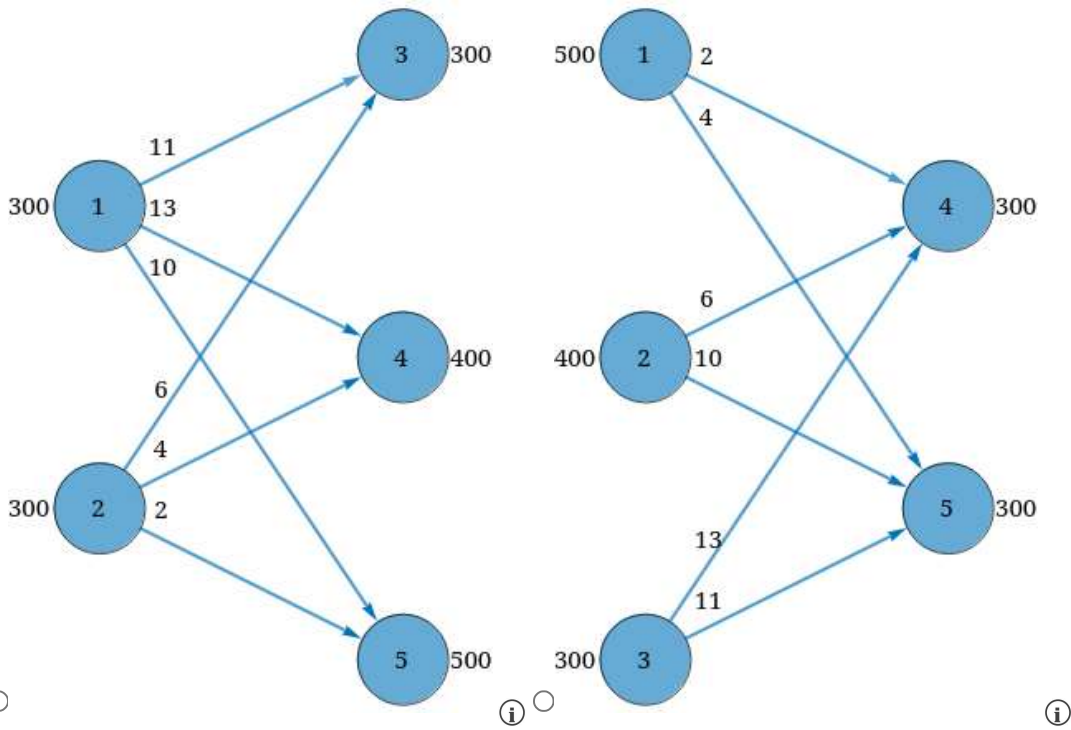
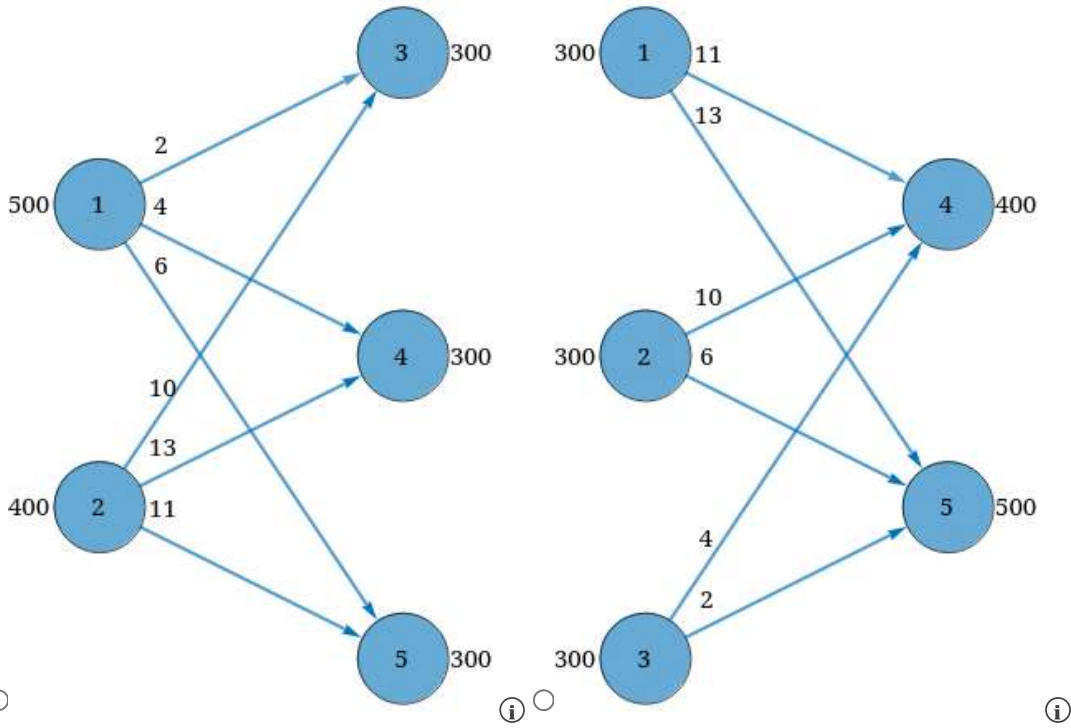
$$x_{23} + x_{24} + x_{25} \leq 400$$

$$x_{13} + x_{23} = 300$$

$$x_{14} + x_{24} = 300$$

$$x_{15} + x_{25} = 300$$

$$x_{ij} \geq 0$$



**Show My Work**

(Optional) ?

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