Homework Assignment #2

Due Jun 26 at 11:59pm **Points** 20 **Questions** 17 **Time Limit** None
Allowed Attempts 2

Instructions

- This homework assignment will evaluate your understanding of the concepts covered in Chapter 2.
- You will need to follow course material and be able to search online code-sharing platforms to complete assignments using R.
- There is no time limit.
- You have TWO attempts to work on this homework and the highest one will be kept.
- You will be able to see the correct answers only after the last attempt.

Take the Quiz Again

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	120 minutes	17.7 out of 20

Answers will be shown after your last attempt

Score for this attempt: **17.7** out of 20
Submitted Jun 24 at 9:50am
This attempt took 120 minutes.

Partial

Question 1 — 0.67 / 1 pts

Quality Air Conditioning manufactures three home air conditioners: an economy model, a standard model, and a deluxe model. The profits per unit are $63, $95, and $135, respectively. The production requirements per unit are as follows:

	Number of Fans	Number of Cooling Coils	Manufacturing Time (hours)

Economy	1	1	8
Standard	1	2	12
Deluxe	1	4	14

For the coming production period, the company has 260 fan motors, 340 cooling coils, and 2,600 hours of manufacturing time available. How many economy models (*E*), standard models (*S*), and deluxe models (*D*) should the company produce in order to maximize profit? The linear programming model for the problem is as follows:

Max 63E + 95S + 135D

s.t.

1E	+ 1S	+ 1D	≤ 260	Fan motors
1E	+ 2S	+ 4D	≤ 340	Cooling coils
8E	+ 12S	+ 14D	≤ 2,600	Manufacturing time
		E, S, D	≥ 0	

The computer solution is shown below.

Optimal Objective Value = 18940.00000

Variable	Value	Reduced Cost
E	180.00000	0.00000
S	80.00000	0.00000
D	0.00000	−24.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	31.00000
2	0.00000	32.00000
3	200.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
E	63.00000	12.00000	15.50000
S	95.00000	31.00000	8.00000
D	135.00000	24.00000	Infinite

Constraint	RHS Value	Allowable Increase	Allowable Decrease

1	260.00000	50.00000	90.00000
2	340.00000	50.00000	80.00000
3	2600.00000	Infinite	200.00000

Question

Identify the range of optimality for each objective function coefficient. (If there is no upper or lower limit, enter NO LIMIT.)

E 47.5 to 75

S 87 to 126

D 111 to NO LIMIT

Answer 1:

47.5

Answer 2:

75

Answer 3:

87

Answer 4:

126

Answer 5:

111

Answer 6:

NO LIMIT

Question 2

1 / 1 pts

Quality Air Conditioning manufactures three home air conditioners: an economy model, a standard model, and a deluxe model. The profits per unit are $63, $95, and $135, respectively. The production requirements per unit are as follows:

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Max 63E + 95S + 135D

s.t.

1E + 1S +	1D	≤	260	Fan motors
1E + 2S +	4D	≤	340	Cooling coils
8E + 12S +	14D	≤	2,600	Manufacturing time
	E, S, D	≥	0	

The computer solution is shown below.

Optimal Objective Value = 18940.00000

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E	180.00000	0.00000
S	80.00000	0.00000
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Constraint	Slack/Surplus	Dual Value
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2	0.00000	32.00000
3	200.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
E	63.00000	12.00000	15.50000
S	95.00000	31.00000	8.00000
D	135.00000	24.00000	Infinite

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	260.00000	50.00000	90.00000
2	340.00000	50.00000	80.00000
3	2600.00000	Infinite	200.00000

Question

Suppose the profit for the economy model is increased by $6 per unit, the profit for the standard model is decreased by $2 per unit, and the profit for the deluxe model is increased by $4 per unit. What will the new optimal solution be?

E 180 units

S 80 units

D 0 units

profit $ 19860

Answer 1:

180

Answer 2:

80

Answer 3:

0

Answer 4:

19860

Question 3

1 / 1 pts

Quality Air Conditioning manufactures three home air conditioners: an economy model, a standard model, and a deluxe model. The profits per unit are $63, $95, and $135, respectively. The production requirements per unit are as follows:

	Number of Fans	Number of Cooling Coils	Manufacturing Time (hours)
Economy	1	1	8
Standard	1	2	12
Deluxe	1	4	14

For the coming production period, the company has 260 fan motors, 340 cooling coils, and 2,600 hours of manufacturing time available. How many economy models (*E*), standard models (*S*), and deluxe models (*D*) should the company produce in order to maximize profit? The linear programming model for the problem is as follows:

Max 63E + 95S + 135D

s.t.

1E + 1S +	1D	≤ 260	Fan motors
1E + 2S +	4D	≤ 340	Cooling coils
8E + 12S +	14D	≤ 2,600	Manufacturing time
	E, S, D	≥ 0	

The computer solution is shown below.

Optimal Objective Value = 18940.00000

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E	180.00000	0.00000
S	80.00000	0.00000
D	0.00000	−24.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	31.00000
2	0.00000	32.00000
3	200.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
E	63.00000	12.00000	15.50000
S	95.00000	31.00000	8.00000
D	135.00000	24.00000	Infinite

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	260.00000	50.00000	90.00000
2	340.00000	50.00000	80.00000
3	2600.00000	Infinite	200.00000

Question

Identify the range of feasibility for the right-hand-side values. (If there is no upper or lower limit, enter NO LIMIT.)

constraint 1 170 to 310

constraint 2 260 to 390

constraint 3 2400 to NO LIMIT

Answer 1:

170

Answer 2:

310

Answer 3:

260

Answer 4:

390

Answer 5:

2400

Answer 6:

NO LIMIT

Question 4

1 / 1 pts

Quality Air Conditioning manufactures three home air conditioners: an economy model, a standard model, and a deluxe model. The profits per unit are $63, $95, and $135, respectively. The production requirements per unit are as follows:

	Number of Fans	Number of Cooling Coils	Manufacturing Time (hours)
Economy	1	1	8
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For the coming production period, the company has 260 fan motors, 340 cooling coils, and 2,600 hours of manufacturing time available. How many economy models (*E*), standard models (*S*), and deluxe models (*D*) should the company produce in order to maximize profit? The linear programming model for the problem is as follows:

Max 63E + 95S + 135D

s.t.

1E + 1S + 1D ≤ 260	Fan motors
1E + 2S + 4D ≤ 340	Cooling coils
8E + 12S + 14D ≤ 2,600	Manufacturing time
E, S, D ≥ 0	

The computer solution is shown below.

Optimal Objective Value = 18940.00000

Variable	Value	Reduced Cost
E	180.00000	0.00000
S	80.00000	0.00000
D	0.00000	−24.00000

Constraint	Slack/Surplus	Dual Value
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2	0.00000	32.00000
3	200.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
E	63.00000	12.00000	15.50000
S	95.00000	31.00000	8.00000
D	135.00000	24.00000	Infinite

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	260.00000	50.00000	90.00000
2	340.00000	50.00000	80.00000
3	2600.00000	Infinite	200.00000

Question

If the number of fan motors available for production is increased by 70, will the dual value for that constraint change? Explain.

- No, the dual value will not change because 70 is less than the allowable increase of 310.
- Yes, the dual value will change because 70 is greater than the allowable increase of 12.

Yes, the dual value will change because 70 is greater than the allowable increase of 50.

No, the dual value will not change because there is no upper limit to how much the constraint can increase.

Partial

Question 5

1.75 / 2 pts

Gulf Coast Electronics is ready to award contracts to suppliers for providing reservoir capacitors for use in its electronic devices. For the past several years, Gulf Coast Electronics has relied on two suppliers for its reservoir capacitors: Able Controls and Lyshenko Industries. A new firm, Boston Components, has inquired into the possibility of providing a portion of the reservoir capacitors needed by Gulf Coast.

The quality of products provided by Lyshenko Industries has been extremely high; in fact, only 0.5% of the capacitors provided by Lyshenko had to be discarded because of quality problems. Able Controls has also had a high-quality level historically, producing an average of only 1% unacceptable capacitors. Because Gulf Coast Electronics has had no experience with Boston Components, it estimated Boston Components' defective rate to be 10%.

Gulf Coast would like to determine how many reservoir capacitors should be ordered from each firm to obtain 75,000 acceptable-quality capacitors to use in its electronic devices. To ensure that Boston Components will receive some of the contracts, management specified that the volume of reservoir capacitors awarded to Boston Components must be at least 10% of the volume given to Able Controls.

In addition, the total volume assigned to Boston Components, Able Controls, and Lyshenko Industries should not exceed 30,000, 50,000, and 50,000 capacitors, respectively. Because of Gulf Coast's long-term relationship with Lyshenko Industries, management also specified that at least 30,000 capacitors should be ordered from Lyshenko.

The cost per capacitor is $2.45 for Boston Components, $2.50 for Able Controls, and $2.75 for Lyshenko Industries.

Question

Formulate a linear program for determining how many reservoir capacitors should be ordered from each supplier to minimize the total cost of obtaining 75,000 acceptable-quality reservoir capacitors. (Let B = number of capacitors ordered from Boston Components, A = number of capacitors ordered from Able Controls, and L = number of capacitors ordered from Lyshenko Industries.)

Min 2.45 B + 2.5 A + 2.75 L

s.t.

volume for Boston B<=30000

volume for Able A<=50000

volume for Lyshenko L<= 50000

useful capacitors 0.9 B+ 0.99 A+ 0.995 L=75000

Boston relative to Able 1 -0.1A>=0

Lyshenko minimum L>=30000

B, A, L ≥ 0

Answer 1:

2.45

Answer 2:

2.5

Answer 3:

2.75

Answer 4:

50000

Answer 5:

0.9

Answer 6:

0.99

Answer 7:

0.995

Answer 8:

1

Question 6

1 / 1 pts

Gulf Coast Electronics is ready to award contracts to suppliers for providing reservoir capacitors for use in its electronic devices. For the past several years, Gulf Coast Electronics has relied on two suppliers for its reservoir capacitors: Able Controls and Lyshenko Industries. A new firm, Boston Components, has inquired into the possibility of providing a portion of the reservoir capacitors needed by Gulf Coast.

The quality of products provided by Lyshenko Industries has been extremely high; in fact, only 0.5% of the capacitors provided by Lyshenko had to be discarded because of quality problems. Able Controls has also had a high-quality level historically, producing an average of only 1% unacceptable capacitors. Because Gulf Coast Electronics has had no experience with Boston Components, it estimated Boston Components' defective rate to be 10%.

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In addition, the total volume assigned to Boston Components, Able Controls, and Lyshenko Industries should not exceed 30,000, 50,000, and 50,000 capacitors, respectively. Because of Gulf Coast's long-term

relationship with Lyshenko Industries, management also specified that at least 30,000 capacitors should be ordered from Lyshenko.
The cost per capacitor is $2.45 for Boston Components, $2.50 for Able Controls, and $2.75 for Lyshenko Industries.

Question

Solve the linear program to determine how many reservoir capacitors should be ordered from each supplier. (Round your answers to the nearest integer.)

Boston Components = 4181 capacitors

Able Controls = 41806 capacitors

Lyshenko Industries = 30000 capacitors

Answer 1:

4181

Answer 2:

41806

Answer 3:

30000

Question 7

1 / 1 pts

Gulf Coast Electronics is ready to award contracts to suppliers for providing reservoir capacitors for use in its electronic devices. For the past several years, Gulf Coast Electronics has relied on two suppliers for its reservoir capacitors: Able Controls and Lyshenko Industries. A new firm, Boston Components, has inquired into the possibility of providing a portion of the reservoir capacitors needed by Gulf Coast.
The quality of products provided by Lyshenko Industries has been extremely high; in fact, only 0.5% of the capacitors provided by Lyshenko had to be discarded because of quality problems. Able Controls has also

had a high-quality level historically, producing an average of only 1% unacceptable capacitors. Because Gulf Coast Electronics has had no experience with Boston Components, it estimated Boston Components' defective rate to be 10%.

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In addition, the total volume assigned to Boston Components, Able Controls, and Lyshenko Industries should not exceed 30,000, 50,000, and 50,000 capacitors, respectively. Because of Gulf Coast's long-term relationship with Lyshenko Industries, management also specified that at least 30,000 capacitors should be ordered from Lyshenko.

The cost per capacitor is $2.45 for Boston Components, $2.50 for Able Controls, and $2.75 for Lyshenko Industries.

Question

Suppose that the quality level for reservoir capacitors supplied by Boston Components is much better than estimated, with a defective rate of 2%. What effect, if any, would this quality level have?

- The optimal solution would change, with 7,526 reservoir capacitors assigned to Boston Components.
- The optimal solution would remain the same.
- **The optimal solution would change, with 30,000 reservoir capacitors assigned to Boston Components.**
- The optimal solution would change, with Lyshenko Industries being assigned the maximum of 50,000 reservoir capacitors.

Question 8

1 / 1 pts

Gulf Coast Electronics is ready to award contracts to suppliers for providing reservoir capacitors for use in its electronic devices. For the past several years, Gulf Coast Electronics has relied on two suppliers for its reservoir capacitors: Able Controls and Lyshenko Industries. A new firm, Boston Components, has inquired into the possibility of providing a portion of the reservoir capacitors needed by Gulf Coast.

The quality of products provided by Lyshenko Industries has been extremely high; in fact, only 0.5% of the capacitors provided by Lyshenko had to be discarded because of quality problems. Able Controls has also had a high-quality level historically, producing an average of only 1% unacceptable capacitors. Because Gulf Coast Electronics has had no experience with Boston Components, it estimated Boston Components' defective rate to be 10%.

Gulf Coast would like to determine how many reservoir capacitors should be ordered from each firm to obtain 75,000 acceptable-quality capacitors to use in its electronic devices. To ensure that Boston Components will receive some of the contracts, management specified that the volume of reservoir capacitors awarded to Boston Components must be at least 10% of the volume given to Able Controls.

In addition, the total volume assigned to Boston Components, Able Controls, and Lyshenko Industries should not exceed 30,000, 50,000, and 50,000 capacitors, respectively. Because of Gulf Coast's long-term relationship with Lyshenko Industries, management also specified that at least 30,000 capacitors should be ordered from Lyshenko.

The cost per capacitor is $2.45 for Boston Components, $2.50 for Able Controls, and $2.75 for Lyshenko Industries.

Question

Suppose that management is willing to reconsider their requirement that at least 30,000 capacitors must be ordered from Lyshenko Industries. What effect, if any, would this consideration have on the solution in part (a)?

The total cost will decrease about $2.54 for every unit the required minimum is reduced by, with no lower limit on how much the required minimum can be reduced.

Reducing the requirement will not change the total cost of obtaining the reservoir capacitors.

The total cost will decrease about $0.16 for every unit the required minimum is reduced by, for at least 25,440 capacitors.

The total cost will decrease about $0.22 for every unit the required minimum is reduced by, for at least 21,106 capacitors.

Question 9

2 / 2 pts

Georgia Cabinets manufactures kitchen cabinets that are sold to local dealers throughout the Southeast. Because of a large backlog of orders for oak and cherry cabinets, the company decided to contract with three smaller cabinetmakers to do the final finishing operation. For the three cabinetmakers, the number of hours required to complete all the oak cabinets, the number of hours required to complete all the cherry cabinets, the number of hours available for the final finishing operation, and the cost per hour to perform the work are shown here.

	Cabinetmaker 1	Cabinetmaker 2	Cabinetmaker 3
Hours required to complete all the oak cabinets	50	42	30
Hours required to complete all the cherry cabinets	60	48	35
Hours available	40	30	35
Cost per hour	$36	$42	$55

For example, Cabinetmaker 1 estimates it will take 50 hours to complete all the oak cabinets and 60 hours to complete all the cherry cabinets. However, Cabinetmaker 1 only has 40 hours available for the final finishing operation. Thus, Cabinetmaker 1 can only complete 40/50 = 0.80, or 80%, of the oak cabinets if it worked only on oak cabinets. Similarly, Cabinetmaker 1 can only complete 40/60 = 0.67, or 67%, of the cherry cabinets if it worked only on cherry cabinets.

Question

Formulate a linear programming model that can be used to determine the percentage of oak cabinets and the percentage of cherry cabinets that should be given to each of the three cabinetmakers in order to minimize the total cost of completing both projects. (Let *O*1 = percentage of oak cabinets assigned to cabinetmaker 1, *O*2 = percentage of oak cabinets assigned to cabinetmaker 2, *O*3 = percentage of oak cabinets assigned to cabinetmaker 3, *C*1 = percentage of cherry cabinets assigned to cabinetmaker 1, *C*2 = percentage of cherry cabinets assigned to cabinetmaker 2, and *C*3 = percentage of cherry cabinets assigned to cabinetmaker 3.)

Min [2160] C1 + 2016C2 + 1925C3 + [1800] O1 + [1764] O2 + 1650O3

s.t.

hours available 1 60C1 + 50O1 <= [40]

hours available 2 48C2 + [42] O2 <= 30

hours available 3 [35] C2 + 30O3 <= 35

oak O1 + O2 + O3 = [1]

cherry C1 + C2 + C3 = [1]

O1, O2, O3, C1, C2, C3 ≥ 0

Answer 1:

2160

Answer 2:

1800

Answer 3:

1764

Answer 4:

40

Answer 5:

42

Answer 6:

35

Answer 7:

1

Answer 8:

1

Partial

Question 10

0.29 / 2 pts

Georgia Cabinets manufactures kitchen cabinets that are sold to local dealers throughout the Southeast. Because of a large backlog of orders for oak and cherry cabinets, the company decided to contract with three smaller cabinetmakers to do the final finishing operation. For the three cabinetmakers, the number of hours required to complete all the oak cabinets, the number of hours required to complete all the cherry cabinets, the number of hours available for the final finishing operation, and the cost per hour to perform the work are shown here.

	Cabinetmaker 1	Cabinetmaker 2	Cabinetmaker 3
Hours required to complete all the oak cabinets	50	42	30
Hours required to complete all the cherry cabinets	60	48	35
Hours available	40	30	35
Cost per hour	$36	$42	$55

For example, Cabinetmaker 1 estimates it will take 50 hours to complete all the oak cabinets and 60 hours to complete all the cherry cabinets. However, Cabinetmaker 1 only has 40 hours available for the final finishing operation. Thus, Cabinetmaker 1 can only complete 40/50 = 0.80, or 80%, of the oak cabinets if it worked only on oak cabinets. Similarly, Cabinetmaker 1 can only complete 40/60 = 0.67, or 67%, of the cherry cabinets if it worked only on cherry cabinets.

Question

Solve the model formulated in part (a). What percentage of the oak cabinets and what percentage of the cherry cabinets should be assigned to each cabinetmaker? What is the total cost (in $) of completing both projects? (Round your **percentage values** to **one** decimal place.)

O1 = 0.0 %

O2 = 62.5 %

O3 = 37.5 %

C1 = 27.1 %

C2 = 0.0 %

C3 = 72.90 %

Total Cost = $ 3672.50

Answer 1:

0.0

Answer 2:

62.5

Answer 3:

37.5

Answer 4:

27.1

Answer 5:

0.0

Answer 6:

72.90

Answer 7:

3672.50

Question 11

1 / 1 pts

Georgia Cabinets manufactures kitchen cabinets that are sold to local dealers throughout the Southeast. Because of a large backlog of orders for oak and cherry cabinets, the company decided to contract with three smaller cabinetmakers to do the final finishing operation. For the three cabinetmakers, the number of hours required to complete all the oak cabinets, the number of hours required to complete all the cherry cabinets, the number of hours available for the final finishing operation, and the cost per hour to perform the work are shown here.

	Cabinetmaker 1	Cabinetmaker 2	Cabinetmaker 3
Hours required to complete all the oak cabinets	50	42	30
Hours required to complete all the cherry cabinets	60	48	35
Hours available	40	30	35
Cost per hour	$36	$42	$55

For example, Cabinetmaker 1 estimates it will take 50 hours to complete all the oak cabinets and 60 hours to complete all the cherry cabinets. However, Cabinetmaker 1 only has 40 hours available for the final finishing operation. Thus, Cabinetmaker 1 can only complete 40/50 = 0.80, or 80%, of the oak cabinets if it worked only on oak cabinets. Similarly, Cabinetmaker 1 can only complete 40/60 = 0.67, or 67%, of the cherry cabinets if it worked only on cherry cabinets.

Question

If Cabinetmaker 1 has additional hours available, would the optimal solution change? Explain.

- Yes, each additional hour of time for cabinetmaker 1 will reduce the total cost by $5 per hour.
- No, cabinetmaker 1 has a slack of 37.5 hours, so increasing cabinetmaker 1's time will not reduce costs.
- **No, cabinetmaker 1 has a slack of 26.458 hours, so increasing cabinetmaker 1's time will not reduce costs.**
- Yes, each additional hour of time for cabinetmaker 1 will reduce the total cost by $-1.75 per hour.

Question 12

1 / 1 pts

Georgia Cabinets manufactures kitchen cabinets that are sold to local dealers throughout the Southeast. Because of a large backlog of orders for oak and cherry cabinets, the company decided to contract with three smaller cabinetmakers to do the final finishing operation. For the three cabinetmakers, the number of hours required to complete all the oak cabinets, the number of hours required to complete all the cherry cabinets, the number of hours available for the final finishing operation, and the cost per hour to perform the work are shown here.

	Cabinetmaker 1	Cabinetmaker 2	Cabinetmaker 3
Hours required to complete all the oak cabinets	50	42	30
Hours required to complete all the cherry cabinets	60	48	35
Hours available	40	30	35
Cost per hour	$36	$42	$55

For example, Cabinetmaker 1 estimates it will take 50 hours to complete all the oak cabinets and 60 hours to complete all the cherry cabinets. However, Cabinetmaker 1 only has 40 hours available for the final finishing operation. Thus, Cabinetmaker 1 can only complete 40/50 = 0.80, or 80%, of the oak cabinets if it worked only on oak cabinets. Similarly, Cabinetmaker 1 can only complete 40/60 = 0.67, or 67%, of the cherry cabinets if it worked only on cherry cabinets.

Question

If Cabinetmaker 2 has additional hours available, would the optimal solution change? Explain.

- No, cabinetmaker 2 has a slack of 37.5 hours, so increasing cabinetmaker 2's time will not reduce costs.
- No, cabinetmaker 2 has a slack of 26.458 hours, so increasing cabinetmaker 2's time will not reduce costs.

Yes, each additional hour of time for cabinetmaker 2 will reduce the total cost by $-1.75 per hour.

Yes, each additional hour of time for cabinetmaker 2 will reduce the total cost by $5 per hour.

Question 13

1 / 1 pts

Georgia Cabinets manufactures kitchen cabinets that are sold to local dealers throughout the Southeast. Because of a large backlog of orders for oak and cherry cabinets, the company decided to contract with three smaller cabinetmakers to do the final finishing operation. For the three cabinetmakers, the number of hours required to complete all the oak cabinets, the number of hours required to complete all the cherry cabinets, the number of hours available for the final finishing operation, and the cost per hour to perform the work are shown here.

	Cabinetmaker 1	Cabinetmaker 2	Cabinetmaker 3
Hours required to complete all the oak cabinets	50	42	30
Hours required to complete all the cherry cabinets	60	48	35
Hours available	40	30	35
Cost per hour	$36	$42	$55

For example, Cabinetmaker 1 estimates it will take 50 hours to complete all the oak cabinets and 60 hours to complete all the cherry cabinets. However, Cabinetmaker 1 only has 40 hours available for the final finishing operation. Thus, Cabinetmaker 1 can only complete 40/50 = 0.80, or 80%, of the oak cabinets if it worked only on oak cabinets. Similarly, Cabinetmaker 1 can only complete 40/60 = 0.67, or 67%, of the cherry cabinets if it worked only on cherry cabinets.

Question

Suppose Cabinetmaker 2 reduced its cost to $38 per hour. What effect would this change have on the optimal solution? Explain.
The new objective function coefficients for O2 and C2 are 1596 and 1824, respectively. The optimal solution does not change and has a value of $ 3552.50 .

Answer 1:

1596

Answer 2:

1824

Answer 3:

3552.50

Question 14

1 / 1 pts

The Racing Club of America sponsors driver education events that provide high-performance driving instruction on actual race tracks. Because safety is a primary consideration at such events, many owners elect to install roll bars in their cars. Deegan Industries manufactures two types of roll bars for sports cars. Model DRB is bolted to the car using existing holes in the car's frame. Model DRW is a heavier roll bar that must be welded to the car's frame. Model DRB requires 20 pounds of a special high alloy steel, 40 minutes of manufacturing time, and 60 minutes of assembly time. Model DRW requires 25 pounds of the special high alloy steel, 100 minutes of manufacturing time, and 40 minutes of assembly time. Deegan's steel supplier indicated that at most 38,000 pounds of the high-alloy steel will be available next quarter. In addition, Deegan estimates that 2,000 hours of manufacturing time and 1,800 hours of assembly time will be available next quarter. The profit contributions are $200 per unit for model DRB and $280 per unit for model DRW. The linear programming model for this problem is as follows:

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Max    200DRB  +  280DRW
```

s.t.

20DRB	+ 25DRW	≤ 38,000	Steel available
40DRB	+ 100DRW	≤ 120,000	Manufacturing minutes
60DRB	+ 40DRW	≤ 108,000	Assembly minutes
	DRB, DRW	≥ 0	

The computer solution is shown below.

Optimal Objective Value = 406400.00000

Variable	Value	Reduced Cost
DRB	800.00000	0.00000
DRW	880.00000	0.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	8.80000
2	0.00000	0.60000
3	24800.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
DRB	200.00000	24.00000	88.00000
DRW	280.00000	220.00000	30.00000

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	38000.00000	5636.36364	8000.00000
2	120000.00000	32000.00000	35428.57143
3	108000.00000	Infinite	24800.00000

Question

Another supplier offered to provide Deegan Industries with an additional 500 pounds of the steel alloy at $2 per pound. Should Deegan purchase the additional pounds of the steel alloy? Explain.

- No, the allowable increase for steel is only 24 pounds, so the additional profits are not applicable for 500 pounds.

Yes, the dual value for steel available is 8.8. Each pound of steel will increase profits more than the $2 per pound that the supplier is offering.

No, there is a slack value of 5,636, so additional pounds of steel will not increase profits.

Yes, there is no surplus of steel so any additional steel that becomes available should be purchased.

No, the dual value for steel available is 0.6. Each pound of steel will not increase profits enough to justify the $2 per pound that the supplier is offering.

Question 15

1 / 1 pts

The Racing Club of America sponsors driver education events that provide high-performance driving instruction on actual race tracks. Because safety is a primary consideration at such events, many owners elect to install roll bars in their cars. Deegan Industries manufactures two types of roll bars for sports cars. Model DRB is bolted to the car using existing holes in the car's frame. Model DRW is a heavier roll bar that must be welded to the car's frame. Model DRB requires 20 pounds of a special high alloy steel, 40 minutes of manufacturing time, and 60 minutes of assembly time. Model DRW requires 25 pounds of the special high alloy steel, 100 minutes of manufacturing time, and 40 minutes of assembly time. Deegan's steel supplier indicated that at most 38,000 pounds of the high-alloy steel will be available next quarter. In addition, Deegan estimates that 2,000 hours of manufacturing time and 1,800 hours of assembly time will be available next quarter. The profit contributions are $200 per unit for model DRB and $280 per unit for model DRW. The linear programming model for this problem is as follows:

```
Max    200DRB  +  280DRW
```

s.t.

20DRB	+ 25DRW	≤ 38,000	Steel available
40DRB	+ 100DRW	≤ 120,000	Manufacturing minutes
60DRB	+ 40DRW	≤ 108,000	Assembly minutes
	DRB, DRW	≥ 0	

The computer solution is shown below.

Optimal Objective Value = 406400.00000

Variable	Value	Reduced Cost
DRB	800.00000	0.00000
DRW	880.00000	0.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	8.80000
2	0.00000	0.60000
3	24800.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
DRB	200.00000	24.00000	88.00000
DRW	280.00000	220.00000	30.00000

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	38000.00000	5636.36364	8000.00000
2	120000.00000	32000.00000	35428.57143
3	108000.00000	Infinite	24800.00000

Question

Deegan is considering using overtime to increase the available assembly time. What would you advise Deegan to do regarding this option? Explain.

Constraint 3 has a surplus. Increasing the number of hours of assembly time will improve profits.

Constraint 1 has a slack. Increasing the number of hours of assembly time will not improve profits.

Constraint 3 has a slack. Increasing the number of hours of assembly time will not improve profits.

Constraint 2 has a slack. Increasing the number of hours of assembly time will not improve profits.

Question 16

1 / 1 pts

The Racing Club of America sponsors driver education events that provide high-performance driving instruction on actual race tracks. Because safety is a primary consideration at such events, many owners elect to install roll bars in their cars. Deegan Industries manufactures two types of roll bars for sports cars. Model DRB is bolted to the car using existing holes in the car's frame. Model DRW is a heavier roll bar that must be welded to the car's frame. Model DRB requires 20 pounds of a special high alloy steel, 40 minutes of manufacturing time, and 60 minutes of assembly time. Model DRW requires 25 pounds of the special high alloy steel, 100 minutes of manufacturing time, and 40 minutes of assembly time. Deegan's steel supplier indicated that at most 38,000 pounds of the high-alloy steel will be available next quarter. In addition, Deegan estimates that 2,000 hours of manufacturing time and 1,800 hours of assembly time will be available next quarter. The profit contributions are $200 per unit for model DRB and $280 per unit for model DRW. The linear programming model for this problem is as follows:

Max	200DRB	+	280DRW			
s.t.						
	20DRB	+	25DRW	≤	38,000	Steel available
	40DRB	+	100DRW	≤	120,000	Manufacturing minutes
	60DRB	+	40DRW	≤	108,000	Assembly minutes
			DRB, DRW	≥	0	

The computer solution is shown below.

Optimal Objective Value = 406400.00000

Variable	Value	Reduced Cost
DRB	800.00000	0.00000
DRW	880.00000	0.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	8.80000
2	0.00000	0.60000
3	24800.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
DRB	200.00000	24.00000	88.00000
DRW	280.00000	220.00000	30.00000

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	38000.00000	5636.36364	8000.00000
2	120000.00000	32000.00000	35428.57143
3	108000.00000	Infinite	24800.00000

Question

Because of increased competition, Deegan is considering reducing the price of model DRB such that the new contribution to profit is $175 per unit. How would this change in price affect the optimal solution? Explain.

The objective coefficient range for model DRB shows a lower limit of $ 112 . Thus, the optimal solution will not change and the new value will be $ 386400 .

Answer 1:

112

Answer 2:

386400

Question 17

1 / 1 pts

The Racing Club of America sponsors driver education events that provide high-performance driving instruction on actual race tracks. Because safety is a primary consideration at such events, many owners elect to install roll bars in their cars. Deegan Industries manufactures two types of roll bars for sports cars. Model DRB is bolted to the car using existing holes in the car's frame. Model DRW is a heavier roll bar that must be welded to the car's frame. Model DRB requires 20 pounds of a special high alloy steel, 40 minutes of manufacturing time, and 60 minutes of assembly time. Model DRW requires 25 pounds of the special high alloy steel, 100 minutes of manufacturing time, and 40 minutes of assembly time. Deegan's steel supplier indicated that at most 38,000 pounds of the high-alloy steel will be available next quarter. In addition, Deegan estimates that 2,000 hours of manufacturing time and 1,800 hours of assembly time will be available next quarter. The profit contributions are $200 per unit for model DRB and $280 per unit for model DRW. The linear programming model for this problem is as follows:

Max	200DRB	+	280DRW		
s.t.					
	20DRB	+	25DRW	≤ 38,000	Steel available
	40DRB	+	100DRW	≤ 120,000	Manufacturing minutes
	60DRB	+	40DRW	≤ 108,000	Assembly minutes
			DRB, DRW	≥ 0	

The computer solution is shown below.

Optimal Objective Value = 406400.00000

Variable	Value	Reduced Cost
DRB	800.00000	0.00000
DRW	880.00000	0.00000

Constraint	Slack/Surplus	Dual Value
1	0.00000	8.80000
2	0.00000	0.60000

3	24800.00000	0.00000

Variable	Objective Coefficient	Allowable Increase	Allowable Decrease
DRB	200.00000	24.00000	88.00000
DRW	280.00000	220.00000	30.00000

Constraint	RHS Value	Allowable Increase	Allowable Decrease
1	38000.00000	5636.36364	8000.00000
2	120000.00000	32000.00000	35428.57143
3	108000.00000	Infinite	24800.00000

Question

If the available manufacturing time is increased by 500 hours, will the dual value for the manufacturing time constraint change? Explain.

- (●) The allowable increase is 32,000 minutes, so the dual value for this constraint will not change.
- ( ) The allowable increase is 24,800 minutes, so the dual value for this constraint will not change.
- ( ) The allowable increase is 32,000 minutes, so the dual value for this constraint will change.
- ( ) The allowable increase is 35,428 minutes, so the dual value for this constraint will not change.

Quiz Score: **17.7** out of 20