Homework Assignment #3

Due Jul 3 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 4.
- 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	234 minutes	19.83 out of 20

Answers will be shown after your last attempt

Score for this attempt: **19.83** out of 20
Submitted Jul 2 at 12:53pm
This attempt took 234 minutes.

Question 1 — 2 / 2 pts

Frandec Company manufactures, assembles, and rebuilds material-handling equipment used in warehouses and distribution centers. One product, called a Liftmaster, is assembled from four components: a frame, a motor, two supports, and a metal strap. Frandec's production schedule calls for 4,500 Liftmasters to be made next month. Frandec purchases the motors from an outside supplier, but the frames, supports, and straps may

be either manufactured by the company or purchased from an outside supplier. Manufacturing and purchase costs per unit are shown.

Component	Manufacturing Cost	Purchase Cost
Frame	$39.00	$52.00
Support	$12.50	$16.00
Strap	$7.50	$8.50

Three departments are involved in the production of these components. The time (in minutes per unit) required to process each component in each department and the available capacity (in hours) for the three departments are as follows.

Component	Department		
	Cutting	Milling	Shaping
Frame	3.5	2.2	3.1
Support	1.3	1.7	2.6
Strap	0.8	—	1.7
Capacity (hours)	350	420	680

Question

Formulate and solve a linear programming model for this make-or-buy application. (Let FM = number of frames manufactured, FP = number of frames purchased, SM = number of supports manufactured, SP = number of supports purchased, TM = number of straps manufactured, and TP = number of straps purchased. Express time in minutes per unit.)

Min 39 FM+52FP+ 12.5 SM+16SP+ 7.5 TM+8.5TP

Cutting constraint 3.5FM+1.3SM+ 0.8 TM<=21000

Milling constraint 2.2FM+ 1.7 SM<=25200

Shaping constraint 3.1FM+2.6SM+1.7TM<= 40800

Frame constraint FM+FP>= 4500

Support constraint SM+SP>=9000

Strap constraint TM+TP>=4500

FM, FP, SM, SP, TM, TP ≥ 0

Answer 1:

39

Answer 2:

12.5

Answer 3:

7.5

Answer 4:

0.8

Answer 5:

1.7

Answer 6:

40800

Answer 7:

4500

Question 2

1 / 1 pts

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	Cutting	Milling	Shaping
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Support	1.3	1.7	2.6
Strap	0.8	—	1.7
Capacity (hours)	350	420	680

Question

How many of each component should be manufactured and how many should be purchased? (Round your answers to the nearest whole number.)
(*FM*, *FP*, *SM*, *SP*, *TM*, *TP*) = _____

- (4038, 0, 4500, 4500, 4962, 0)
- (4500, 0, 4038, 4962, 0, 4500)
- (0, 0, 0, 4500, 9000, 4500)
- (21000, 25200, 40800, 4500, 9000)

Question 3

1 / 1 pts

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Support	1.3	1.7	2.6
Strap	0.8	—	1.7
Capacity (hours)	350	420	680

Question

What is the total cost (in $) of the manufacturing and purchasing plan?

- $991,262.00
- $40,800.00
- $343,615.38

$58,665.27

Question 4

1 / 1 pts

Frandec Company manufactures, assembles, and rebuilds material-handling equipment used in warehouses and distribution centers. One product, called a Liftmaster, is assembled from four components: a frame, a motor, two supports, and a metal strap. Frandec's production schedule calls for 4,500 Liftmasters to be made next month. Frandec purchases the motors from an outside supplier, but the frames, supports, and straps may be either manufactured by the company or purchased from an outside supplier. Manufacturing and purchase costs per unit are shown.

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Component	Department		
	Cutting	Milling	Shaping
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Support	1.3	1.7	2.6
Strap	0.8	—	1.7
Capacity (hours)	350	420	680

Question

How many hours of production time are used in each department? (Round your answers to two decimal places.)

Cutting = 350 hrs

Milling = 279.42 hrs

Shaping = 407.50 hrs

Answer 1:

350

Answer 2:

279.42

Answer 3:

407.50

Question 5

1 / 1 pts

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Component	Department		
	Cutting	Milling	Shaping

Frame	3.5	2.2	3.1
Support	1.3	1.7	2.6
Strap	0.8	—	1.7
Capacity (hours)	350	420	680

Question

How much (in $) should Frandec be willing to pay for an additional hour of time in the shaping department?

- $350
- $4,500
- $343,615.38
- $0

Question 6

1 / 1 pts

Frandec Company manufactures, assembles, and rebuilds material-handling equipment used in warehouses and distribution centers. One product, called a Liftmaster, is assembled from four components: a frame, a motor, two supports, and a metal strap. Frandec's production schedule calls for 4,500 Liftmasters to be made next month. Frandec purchases the motors from an outside supplier, but the frames, supports, and straps may be either manufactured by the company or purchased from an outside supplier. Manufacturing and purchase costs per unit are shown.

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Strap	0.8	—	1.7
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Question

Another manufacturer has offered to sell frames to Frandec for $45 each. Could Frandec improve its position by pursuing this opportunity? Why or why not? (Round your answer to three decimal places.)

- Yes. The reduced cost of 3.577 indicates that the solution can be improved.
- No. The reduced cost of 3.577 indicates that the solution cannot be improved.
- No. The reduced cost of 5.714 indicates that the solution cannot be improved.
- Yes. The reduced cost of 5.714 indicates that the solution can be improved.

Question 7

2 / 2 pts

The employee credit union at State University is planning the allocation of funds for the coming year. The credit union makes four types of loans to its members. In addition, the credit union invests in risk-free securities to stabilize income. The various revenue-producing investments together with annual rates of return are as follows.

Type of Loan/Investment	Annual Rate of Return (%)
Automobile loans	7
Furniture loans	9
Other secured loans	10
Signature loans	11
Risk-free securities	8

The credit union will have $2,400,000 available for investment during the coming year. State laws and credit union policies impose the following restrictions on the composition of loans and investments.

- Risk-free securities may not exceed 30% of the total funds available for investment.
- Signature loans may not exceed 10% of the funds invested in all loans (automobile, furniture, other secured, and signature loans).
- Furniture loans plus other secured loans may not exceed automobile loans.
- Other secured loans plus signature loans may not exceed the funds invested in risk-free securities.

Question

How should the $2,400,000 be allocated to each of the loan/investment alternatives to maximize total annual return?
(Round your answers to the nearest integer)

	$
Automobile loans	756000

Furniture loans	$ 204000
Other secured loans	$ 552000
Signature loans	$ 168000
Risk-free securities	$ 720000

Answer 1:

756000

Answer 2:

204000

Answer 3:

552000

Answer 4:

168000

Answer 5:

720000

Question 8

1 / 1 pts

The employee credit union at State University is planning the allocation of funds for the coming year. The credit union makes four types of loans to its members. In addition, the credit union invests in risk-free securities to

stabilize income. The various revenue-producing investments together with annual rates of return are as follows.

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- Furniture loans plus other secured loans may not exceed automobile loans.
- Other secured loans plus signature loans may not exceed the funds invested in risk-free securities.

Question

What is the projected total annual return?
(Round your answers to the nearest integer)

- $240,000
- $179,850
- $756,000
- (selected) $202,560

Partial

Question 9

0.83 / 1 pts

Epsilon Airlines services predominately the eastern and southeastern United States. A vast majority of Epsilon's customers make reservations through Epsilon's website, but a small percentage of customers make reservations via phone. Epsilon employs call-center personnel to handle these reservations along with any problems with the website reservation system and for the rebooking of flights for customers if their plans change or their travel is disrupted. Staffing the call center appropriately is a challenge for Epsilon's management team. Having too many employees on hand is a waste of money, but having too few results in very poor customer service and the potential loss of customers.

Epsilon analysts have estimated the minimum number of call-center employees needed by the day of the week for the upcoming vacation season (June, July, and the first two weeks of August). These estimates are given in the following table.

Day	Minimum Number of Employees Needed
Monday	75
Tuesday	45
Wednesday	40
Thursday	70
Friday	95
Saturday	90
Sunday	60

The call-center employees work five consecutive days and then have two consecutive days off. An employee may start work any day of the week. Each call-center employee receives the same salary. Assume that the schedule cycles and ignore the start-up and stopping of the schedule.

Question

Develop a model that will minimize the total number of call-center employees needed to meet the minimum requirements.

(Let X_i = the number of call-center employees who start work on the day *i* where i = 1 = Monday, i = 2 = Tuesday, etc).

Min $X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_7$

s.t.

Monday	$X_1 + X_4 + X_5 + X_6 + X_7$	>=	75
Tuesday	$X_1 + X_2 + X_5 + X_6 + X_7$	>=	45
Wednesday	X3 + X_2 + X_3 + X_6 + X_7	>=	40
Thursday	$X_1 + X_2 + X_3 + X_4$ + X7	>=	70
Friday	$X_1 + X_2 + X_3 + X_4$ + X5	>=	95
Saturday	$X_2 + X_3 + X_4 + X_5 + X_6$	>=	90
Sunday	$X_3 + X_4 + X_5 + X_6 + X_7$	>=	60
	$X_1, X_2, X_3, X_4, X_5, X_6, X_7$	>=	0

Answer 1:

75

Answer 2:

45

Answer 3:

X3

Answer 4:

X7

Answer 5:

X5

Answer 6:

0

Question 10

1 / 1 pts

Epsilon Airlines services predominately the eastern and southeastern United States. A vast majority of Epsilon's customers make reservations through Epsilon's website, but a small percentage of customers make reservations via phone. Epsilon employs call-center personnel to handle these reservations along with any problems with the website reservation system and for the rebooking of flights for customers if their plans change or their travel is disrupted. Staffing the call center appropriately is a challenge for Epsilon's management team. Having too many employees on hand is a waste of money, but having too few results in very poor customer service and the potential loss of customers.

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The call-center employees work five consecutive days and then have two consecutive days off. An employee may start work any day of the week. Each call-center employee receives the same salary. Assume that the schedule cycles and ignore the start-up and stopping of the schedule.

Question

Find the optimal solution.

(Round your answers to the nearest integer)

X1 = 10

X2 = 25

X3 = 0

X4 = 55

X5 = 5

X6 = 5

X7 = 0

Answer 1:

10

Answer 2:

25

Answer 3:

5

Answer 4:

5

Question 11

1 / 1 pts

Epsilon Airlines services predominately the eastern and southeastern United States. A vast majority of Epsilon's customers make reservations through Epsilon's website, but a small percentage of customers make reservations via phone. Epsilon employs call-center personnel to handle these reservations along with any problems with the website reservation system and for the rebooking of flights for customers if their plans change or their travel is disrupted. Staffing the call center appropriately is a challenge for Epsilon's management team. Having too many employees

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Question

Give the number of call-center employees that exceed the minimum required.

(Round your answers to the nearest integer)

Monday = 0

Tuesday = 0

Wednesday = 0

Thursday = 20

Friday = 0

Saturday = 0

Sunday = 5

Answer 1:

0

Answer 2:

20

Answer 3:

5

Question 12

2 / 2 pts

Suppose you work for CNN.com and are in charge of selling banner ads for next Friday. You contract with companies to plan how many visitors to the CNN website are shown ads for their products. A visitor being exposed to one of the company's ads is known as an impression. You are paid based on how many of the impressions lead to a click-through to the company's website.

Factoring in the click-through rates and the revenue per click-through, you have calculated the following *expected revenue per impression* for three sections of the website (Business, Science, and Sports) for three of your client companies (Nike, Oracle, and P&G).

Expected Revenue per Impression ($)

Section	Nike	Oracle	P&G
Business	0.002	0.006	0.007
Science	0.003	0.007	0.005
Sports	0.005	0.002	0.003

Maximum Total Impressions by Section

Business	2,600,000
Science	1,000,000

Sports	1,900,000

Your contracts specify lower and upper bounds on how many total impressions you will allocate to each client company (across both sections). Each company must be allocated at least 1,000,000 impressions, but no more than 2,000,000. (Let X_{ij} = the number of impressions allocated to section i to company j. Let i = 1 represent Business, i = 2 represent Science, and i = 3 represent Sports. Let j = 1 represent Nike, j = 2 represent Oracle, and j = 3 represent P&G.)

Question

Formulate and solve a linear programming model to maximize revenue (in $) from these banner ads. How many impressions should be allocated to each section for each company?

(Round your answers to the nearest integer)

X_{11} = 0

X_{12} = 600000

X_{13} = 2000000

X_{21} = 0

X_{22} = 1000000

X_{23} = 0

X_{31} = 1900000

X_{32} = 0

X_{33} = 0

Answer 1:

0

Answer 2:

600000

Answer 3:

2000000

Answer 4:

0

Answer 5:

1000000

Answer 6:

0

Answer 7:

1900000

Answer 8:

0

Answer 9:

0

Question 13

1 / 1 pts

Suppose you work for CNN.com and are in charge of selling banner ads for next Friday. You contract with companies to plan how many visitors to the CNN website are shown ads for their products. A visitor being exposed to one of the company's ads is known as an impression. You are paid based on how many of the impressions lead to a click-through to the company's website.

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Question

What is the optimal revenue (in $)?

(Round your answers to the nearest integer)

- $15,670
- $56,520
- $332,980
- $34,100

Question 14

1 / 1 pts

The Clark County Sheriff's Department schedules police officers for 8-hour shifts. The beginning times for the shifts are 8:00 a.m., noon, 4:00 p.m., 8:00 p.m., midnight, and 4:00 a.m. An officer beginning a shift at one of these times works for the next 8 hours. During normal weekday operations, the number of officers needed varies depending on the time of day.

The department staffing guidelines require the following minimum number of officers on duty:

Time of Day	Minimum Officers Time of Day on Duty
8:00 A.M. – Noon	6
Noon – 4:00 P.M.	5
4:00 P.M. – 8:00 P.M.	9
8:00 P.M. – Midnight	6
Midnight – 4:00 A.M.	5
4:00 A.M. – 8:00 A.M.	5

Question

Determine the number of police officers that should be scheduled to begin the 8-hour shifts at each of the six times (8:00 a.m., noon, 4:00 p.m., 8:00 p.m., midnight, and 4:00 a.m.) to minimize the total number of officers required. (*Hint*: Let x_1 = the number of officers beginning work at 8:00 a.m., x_2 = the number of officers beginning work at noon, and so on.)

At least how many officials are needed? 20

Answer 1:

20

Question 15

1 / 1 pts

As part of the settlement for a class action lawsuit, Hoxworth Corporation must provide sufficient cash to make the following annual payments (in thousands of dollars).

Year	1	2	3	4	5	6
Payment	160	185	210	255	285	430

The annual payments must be made at the beginning of each year. The judge will approve an amount that, along with earnings on its investment, will cover the annual payments. Investment of the funds will be limited to savings (at 4% annually) and government securities, at prices and rates currently quoted in The Wall Street Journal.

Hoxworth wants to develop a plan for making the annual payments by investing in the following securities (par value = $1,000). Funds not invested in these securities will be placed in savings.

Security	Current Price	Rate (%)	Years to Maturity
1	$1,055	6.750	3
2	$1,000	5.125	4

Assume that interest is paid annually. The plan will be submitted to the judge and, if approved, Hoxworth will be required to pay a trustee the amount that will be required to fund the plan.

Question

Use linear programming to find the minimum cash settlement necessary (in $) to fund the annual payments. (Round your answer to the nearest dollar.)

- (●) $1,324,240
- ( ) $773,580
- ( ) $560,752
- ( ) $2,980,224

Question 16

1 / 1 pts

As part of the settlement for a class action lawsuit, Hoxworth Corporation must provide sufficient cash to make the following annual payments (in thousands of dollars).

Year	1	2	3	4	5	6
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Assume that interest is paid annually. The plan will be submitted to the judge and, if approved, Hoxworth will be required to pay a trustee the amount that will be required to fund the plan.

Question

Use the dual value to determine how much more (in $) Hoxworth should be willing to pay now to reduce the payment at the beginning of year 6 to $400,000. (Round your answer to the nearest dollar.)

- ○ $45,550
- ○ $12,000
- ○ $36,750
- ◉ $23,565

Question 17

1 / 1 pts

As part of the settlement for a class action lawsuit, Hoxworth Corporation must provide sufficient cash to make the following annual payments (in thousands of dollars).

Year	1	2	3	4	5	6
Payment	160	185	210	255	285	430

The annual payments must be made at the beginning of each year. The judge will approve an amount that, along with earnings on its investment, will cover the annual payments. Investment of the funds will be limited to savings (at 4% annually) and government securities, at prices and rates currently quoted in The Wall Street Journal.

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Assume that interest is paid annually. The plan will be submitted to the judge and, if approved, Hoxworth will be required to pay a trustee the amount that will be required to fund the plan.

Question

Suppose that the annual payments are to be made at the end of each year. Reformulate the model to accommodate this change. How much would Hoxworth save (in $) if this change could be negotiated? (Round your answer to the nearest dollar.)

- $9,671
- $34,580
- $59,887
- $67,885

Quiz Score: **19.83** out of 20