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973023817

STATS 255 Assignment 1

1.

a. Decision variables: S = number of Sumo figures produced, Luchador = number of Luchador figures produced, J = number of Ju Jitsu figures produced

b. Objective function:

MAX: Earnings = 2.5S + 2.5J + 3.5L

Constraints:

5S + 2L <= 500,000

3L + 8J <= 200,000

S + L + J >= 5,000

3S + 7L + 2J <= 12,000

S, L, J >= 0

c.

	A	B	C	D	E	F	G	H	I	J
1	***Figurine Production***	**Sumo**	**Luchador**	**Ju Jitsu**					**Liam Rohrer**	
2		0	0	6000					**lroh486**	
3									**973023817**	
4	**Max**	2.5	3.5	2.5	15000					
5	**Constraints**	5	2		0	<=	500000			
6			3	8	48000	<=	200000			
7		1	1	1	6000	>=	5000			
8		3	7	2	12000	<=	12000			
9										

	A	B	C	D	E	F	G	H	I	J
1	***Figurine Production***	**Sumo**	**Luchador**	**Ju Jitsu**					**Liam Rohrer**	
2		0	0	6000					**lroh486**	
3									**973023817**	
4	**Max**	2.5	3.5	2.5	=SUMPRODUCT($B$2:$D$2, B4:D4)					
5	**Constraints**	5	2		=SUMPRODUCT($B$2:$D$2, B5:D5)	<=	500000			
6			3	8	=SUMPRODUCT($B$2:$D$2, B6:D6)	<=	200000			
7		1	1	1	=SUMPRODUCT($B$2:$D$2, B7:D7)	>=	5000			
8		3	7	2	=SUMPRODUCT($B$2:$D$2, B8:D8)	<=	12000			
9										

Microsoft Excel 16.0 Sensitivity Report
Worksheet: [STATS255_Assignment1.xlsx]Figurine Production
Report Created: 3/18/2025 12:57:20 PM

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$2	Sumo	0	-1.25	2.5	1.25	1E+30
$C$2	Luchador	0	-5.25	3.5	5.25	1E+30
$D$2	Ju Jitsu	6000	0	2.5	1E+30	0.833333333

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$E$8		12000	1.25	12000	38000	2000
$E$5	Constraints	0	0	500000	1E+30	500000
$E$6		48000	0	200000	1E+30	152000
$E$7		6000	0	5000	1000	1E+30

d. Gains Workshop should produce 0 Sumo figures, 0 Luchador figures, and 6,000 Ju Jitsu figures to maximize their earnings. Doing this, they will earn $15,000.

e. We see an infinite allowable decrease in our objective coefficient for Luchador figures because we are currently producing 0, and an allowable increase of 5.25. This tells us that the earnings from each Luchador figure would need to increase by at least 5.25 dollars before Gains Workshop would produce them for an optimal outcome.

f. Decision variables: S = number of Sumo figures produced, Luchador = number of Luchador figures produced, J = number of Ju Jitsu figures produced, T = number of tag-team figures produced

Objective function:

MAX: Earnings = 2.5S + 2.5J + 3.5L + 7T

Constraints:

5S + 2L + 7T <= 500,000

3L + 8J + 3T<= 200,000

S + L + J + T>= 5,000

3S + 7L + 2J + 11T <= 12,000

S, L, J, T >= 0

2.

a. Decision variables: A = dollars invested in stock A, B = dollars invested in stock B, C = dollars invested in stock C, D = dollars invested in stock D, E = dollars invested in stock E, F = dollars invested in stock F, MB = money borrowed from the cryptocurrency market

b. Objective function:

MAX: Potential Gains = 0.7A + 1.5B + 2C + 1.2D + 3E + 0.4F – 0.2MB

Constraints:

A + B + C + D + E + F <= 400,000

MB >= 0

2.5A + 0.5B + 1.2C + 0.8D + 1.4E + 3.7F >= 400,000

B, D >= 50,000

A, B, C, D, E, F <= 100,000

A, B, C, D, E, F >= 0

c.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	***Investment Strategy***	**A**	**B**	**C**	**D**	**E**	**F**	**Money Borrowed**					**Liam Rohrer**
2		0	100000	100000	96551.72414	100000	3448.275862	200000					**lroh486**
3													**973023817**
4	**Max**	0.7	1.5	2	1.2	3	0.4	-0.2	727241.3793				
5	**Constraints**	1	1	1	1	1	1		400000	<=	400000		
6								1	200000	>=	0		
7		2.5	0.5	1.2	0.8	1.4	3.7		400000	>=	400000		
8			1						100000	>=	50000		
9					1				96551.72414	>=	50000		
10		1							0	<=	100000		
11			1						100000	<=	100000		
12				1					100000	<=	100000		
13					1				96551.72414	<=	100000		
14						1			100000	<=	100000		
15							1		3448.275862	<=	100000		

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	***Investment Strategy***	**A**	**B**	**C**	**D**	**E**	**F**	**Money Borrowed**					**Liam Rohrer**
2		0	100000	100000	96551.7241379311	100000	3448.27586206894	=SUM(B2:G2)-200000					**lroh486**
3													**973023817**
4	**Max**	0.7	1.5	2	1.2	3	0.4	-0.2	=SUMPRODUCT($B$2:$H$2, B4:H4)				
5	**Constraints**	1	1	1	1	1	1		=SUMPRODUCT($B$2:$H$2, B5:H5)	<=	400000		
6								1	=SUMPRODUCT($B$2:$H$2, B6:H6)	>=	0		
7		2.5	0.5	1.2	0.8	1.4	3.7		=SUMPRODUCT($B$2:$H$2, B7:H7)	>=	400000		
8			1						=SUMPRODUCT($B$2:$H$2, B8:H8)	>=	50000		
9					1				=SUMPRODUCT($B$2:$H$2, B9:H9)	>=	50000		
10		1							=SUMPRODUCT($B$2:$H$2, B10:H10)	<=	100000		
11			1						=SUMPRODUCT($B$2:$H$2, B11:H11)	<=	100000		
12				1					=SUMPRODUCT($B$2:$H$2, B12:H12)	<=	100000		
13					1				=SUMPRODUCT($B$2:$H$2, B13:H13)	<=	100000		
14						1			=SUMPRODUCT($B$2:$H$2, B14:H14)	<=	100000		
15							1		=SUMPRODUCT($B$2:$H$2, B15:H15)	<=	100000		

+

Microsoft Excel 16.0 Sensitivity Report
Worksheet: [STATS255_Assignment1.xlsx]Investment Strategy
Report Created: 3/18/2025 12:57:33 PM

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$B$2	A	0	-0.248275862	0.5	0.248275862	1E+30
$C$2	B	100000	0	1.3	1E+30	0.217241379
$D$2	C	100000	0	1.8	1E+30	0.910344828
$E$2	D	96551.72414	0	1	0.196875	0.8
$F$2	E	100000	0	2.8	1E+30	1.965517241
$G$2	F	3448.275862	0	0.2	0.8	0.36

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$I$10		0	0	100000	1E+30	100000
$I$11		100000	0.217241379	100000	42187.5	3125
$I$12		100000	0.910344828	100000	25000	4000
$I$13		96551.72414	0	100000	1E+30	3448.275862
$I$14		100000	1.965517241	100000	16666.66667	4347.826087
$I$15		3448.275862	0	100000	1E+30	96551.72414
$I$5	Constraints	400000	1.220689655	400000	2702.702703	36486.48649
$I$6		200000	0	0	200000	1E+30
$I$7		400000	-0.275862069	400000	135000	10000
$I$8		100000	0	50000	50000	1E+30
$I$9		96551.72414	0	50000	46551.72414	1E+30

d. For maximum potential gain Mount Street Bets should invest 0 dollars in stock A, 100,000 dollars in stock B, 100,000 dollars in stock C, 96551.72 dollars in stock D, 100,000 dollars in stock E, and 3448.27 dollars in stock F. This will also result in them borrowing the maximum 200,000 dollars from the cryptocurrency market and will lead to a maximum potential gain of 727,241.38 dollars.
e. The shadow price associate with the 100,000 dollar constraint on stock E is 1.965517 with an allowable increase of 16,666.667. This tells us that while within this range every dollar increase in the constraint will result in a 1.965517 dollar increase in our optimal outcome. Therefore a 10,000 dollar increase in the constraint will result in an increase of 10,000*19655.17 = 19,655.17 dollars of potential gain.
f. Decision variables: A = dollars invested in stock A, B = dollars invested in stock B, C = dollars invested in stock C, D = dollars invested in stock D, E = dollars invested in stock E, F = dollars invested in stock F, MB = money borrowed from the cryptocurrency market

   Objective function:

   MAX: Potential Gains = 0.7A + 1.5B + 2C + 1.2D + 3E + 0.4F – 0.2MB

   Constraints:

   A + B + C + D + E + F <= 400,000

   MB >= 0

   2.5A + 0.5B + 1.2C + 0.8D + 1.4E + 3.7F >= 400,000

   B, D >= 50,000

   A, B, C, D, E, F <= 100,000

   A, B, C, D, E, F >= 0

   0.49A - 0.45B + 1.4C – 0.36D – 0.9E – 0.12F >= 0 *Added constraint*

3. (Quiz on canvas)
4.
   a. Knapsack problem
   b. Decision Variables: A = number of object A stored in the container unit, B = number of object B stored in the container unit, C = number of object C stored in the container unit, D = number of object D stored in the container unit, E = number of object E stored in the container unit, F = number of object F stored in the container unit

c. Objective function:

MAX: Value = 10A + 12B + 5C + 10D + 9E + 7F

Constraints:

19A + 9B + 8C + 6.5D + 18E + 27F <= 60

1,200A + 400B + 2,000C + 620D + 500E + 550F <= 3,000

A <= 1, B <= 3, C <= 1, D <= 10, E <= 4, F <= 1

A, B, C, D, E, F >= 0

d.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	***Storage Unit***	**A**	**B**	**C**	**D**	**E**	**F**					**Liam Rohrer**	
2		0	3	0	2	1	0					**lroh486**	
3												**973023817**	
4	**Max**	10	12	5	10	9	7	65					
5	**Constraints**	19	9	8	6.5	18	27	58	<=	60			
6		1200	400	2000	620	500	550	2940	<=	3000			
7		1						0	<=	1			
8			1					3	<=	3			
9				1				0	<=	1			
10					1			2	<=	10			
11						1		1	<=	4			
12							1	0	<=	1			

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	***Storage Unit***	**A**	**B**	**C**	**D**	**E**	**F**					**Liam Rohrer**	
2		0	3	0	2	1	0					**lroh486**	
3												**973023817**	
4	**Max**	10	12	5	10	9	7	=SUMPRODUCT($B$2:$G$2,B4:G4)					
5	**Constraints**	19	9	8	6.5	18	27	=SUMPRODUCT($B$2:$G$2,B5:G5)	<=	60			
6		1200	400	2000	620	500	550	=SUMPRODUCT($B$2:$G$2,B6:G6)	<=	3000			
7		1						=SUMPRODUCT($B$2:$G$2,B7:G7)	<=	1			
8			1					=SUMPRODUCT($B$2:$G$2,B8:G8)	<=	3			
9				1				=SUMPRODUCT($B$2:$G$2,B9:G9)	<=	1			
10					1			=SUMPRODUCT($B$2:$G$2,B10:G10)	<=	10			
11						1		=SUMPRODUCT($B$2:$G$2,B11:G11)	<=	4			
12							1	=SUMPRODUCT($B$2:$G$2,B12:G12)	<=	1			
13													

e. To maximize the value of stored goods the investors should store 0 of object A, 3 of object B, 0 of object C, 2 of object D, 1 of object E, and 0 of object F. This will result in a maximum value of 65,000 dollars.

f. Decision variables: LA = number of laborers starting at 8am, LB = number of laborers starting at 11am, LC = number of laborers starting at 5pm, MA = number of managers starting at 8am, MB = number of managers starting at 11am, LC = number of managers starting 2pm

Objective function:

MIN: Wages = 90LA + 90LB + 90LC + 900MA + 900MB + 900MC

Constraints:

LA + LB + LB <= 15

MA + MB + MC <= 8

LC >= 7

MA >= 2

LA + MA >= 4

LB + MA + MB >= 3

MB + MC >= 5

LC + MC >= 9

LA, LB, LC, MA, MB, MC >= 0