Liam Rohrer

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STATS 255 Assignment 2

1.

a. Decision Variables: X_{ij} where X = the number of that item purchased, i = the product (BA, BE, SH) and j = the brand (BL, LM, VE, GN, WA)

Objective Function: MIN: Sum(X_{ij} * $Cost_{ij}$)

Constraints:

$X_{BA\ BL} + X_{BA\ LM} + X_{BA\ VE} + X_{BA\ GN} + X_{BA\ WA} >= 18$

$X_{BE\ BL} + X_{BE\ LM} + X_{BE\ VE} + X_{BE\ GN} + X_{BE\ WA} >= 11$

$X_{SH\ BL} + X_{SH\ LM} + X_{SH\ VE} + X_{SH\ GN} + X_{SH\ WA} >= 24$

$X_{BA\ BL} + X_{BE\ BL} + X_{SH\ BL} <= 10$

$X_{BA\ LM} + X_{BE\ LM} + X_{SH\ LM} <= 10$

$X_{BA\ VE} + X_{BE\ VE} + X_{SH\ VE} <= 10$

$X_{BA\ GN} + X_{BE\ GN} + X_{SH\ GN} <= 10$

$X_{BA\ WA} + X_{BE\ WA} + X_{SH\ WA} <= 10$

$X_{ij} >= 0$

b.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Costs												
2			Bags	Belts	Shoes							Liam Rohrer	
3		Blurberry	450	590	780							lroh486	
4		Louie Mutton	1500	740	4345							973023817	
5		Versaycee	2200	360	850								
6		Gnocci	1000	1040	1100								
7		Walenciaga	2400	370	1150								
8		Dummy Supply	0	0	0								
9		Total Cost	41320										
10													
11	Constraints												
12			Bags	Belts	Shoes	Total							
13		Blurberry	10	0	0	10	<=	10					
14		Louie Mutton	0	10	0	10	<=	10					
15		Versaycee	0	0	10	10	<=	10					
16		Gnocci	8	0	2	10	<=	10					
17		Walenciaga	0	1	9	10	<=	10					
18		Dummy Supply	0	0	3	3	=	3					
19		Total	18	11	24								
20			>=	>=	>=								
21			18	11	24								
22													

	A	B	C	D	E	F	G	H	I	J	K	L
1	Costs											
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4		Louie Mutton	1500	740	4345							973023817
5		Versaycee	2200	360	850							
6		Gnocci	1000	1040	1100							
7		Walenciaga	2400	370	1150							
8		Dummy Supply	0	0	0							
9		Total Cost	= SUMPRODUCT(C3:E8, C13:E18)									
10												
11	Constraints											
12			Bags	Belts	Shoes	Total						
13		Blurberry	10	0	0	=SUM($C13:$E13)	<=	10				
14		Louie Mutton	0	10	0	=SUM($C14:$E14)	<=	10				
15		Versaycee	0	0	10	=SUM($C15:$E15)	<=	10				
16		Gnocci	8	0	2	=SUM($C16:$E16)	<=	10				
17		Walenciaga	0	1	9	=SUM($C17:$E17)	<=	10				
18		Dummy Supply	0	0	3	=SUM($C18:$E18)	=	3				
19		Total	=SUM(C$13:C$18)	=SUM(D$13:D$18)	=SUM(E$13:E$18)							
20			>=	>=	>=							
21			18	11	24							
22												

Microsoft Excel 16.0 Sensitivity Report
Worksheet: [STATS255_Assignment2.xlsx]MSB Wardrobe
Report Created: 4/9/2025 12:05:07 PM

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
$C$13	Blurberry Bags	10	0	450	230	1E+30
$D$13	Blurberry Belts	0	820	590	1E+30	820
$E$13	Blurberry Shoes	0	230	780	1E+30	230
$C$14	Louie Mutton Bags	0	80	1500	1E+30	80
$D$14	Louie Mutton Belts	10	0	740	80	370
$E$14	Louie Mutton Shoes	0	2825	4345	1E+30	2825
$C$15	Versaycee Bags	0	1450	2200	1E+30	1450
$D$15	Versaycee Belts	0	290	360	1E+30	290
$E$15	Versaycee Shoes	10	0	850	290	1E+30
$C$16	Gnocci Bags	8	0	1000	80	230
$D$16	Gnocci Belts	0	720	1040	1E+30	720
$E$16	Gnocci Shoes	2	0	1100	230	80
$C$17	Walenciaga Bags	0	1350	2400	1E+30	1350
$D$17	Walenciaga Belts	1	0	370	290	80
$E$17	Walenciaga Shoes	9	0	1150	80	290
$C$18	Dummy Supply Bags	0	100	0	1E+30	100
$D$18	Dummy Supply Belts	0	780	0	1E+30	780
$E$18	Dummy Supply Shoes	3	0	0	100	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
$C$19	Total Bags	18	1420	18	0	8
$D$19	Total Belts	11	740	11	0	10
$E$19	Total Shoes	24	1520	24	0	9
$F$13	Blurberry Total	10	-970	10	8	0
$F$14	Louie Mutton Total	10	0	10	1E+30	0
$F$15	Versaycee Total	10	-670	10	9	0
$F$16	Gnocci Total	10	-420	10	9	0
$F$17	Walenciaga Total	10	-370	10	10	0
$F$18	Dummy Supply Total	3	-1520	3	9	0

c. To minimize cost, Mount Street Bets should buy 10 bags from Blurberry and 8 from Louie Mutton, 2 belts from Louie Mutton and 9 from Walenciaga, and 10 pairs of shoes from Versaycee, 10 from Gnocci, and 1 from Walenciaga. This will leave 3 pairs of shoes to be purchased, which can't be [purchased with the given demand constraints.

d. We cannot know exactly how this will affect the optimal solution cost and number of bags purchased because it goes outside of our allowable increase range which is $80. Our solution will change but we will need to resolve.

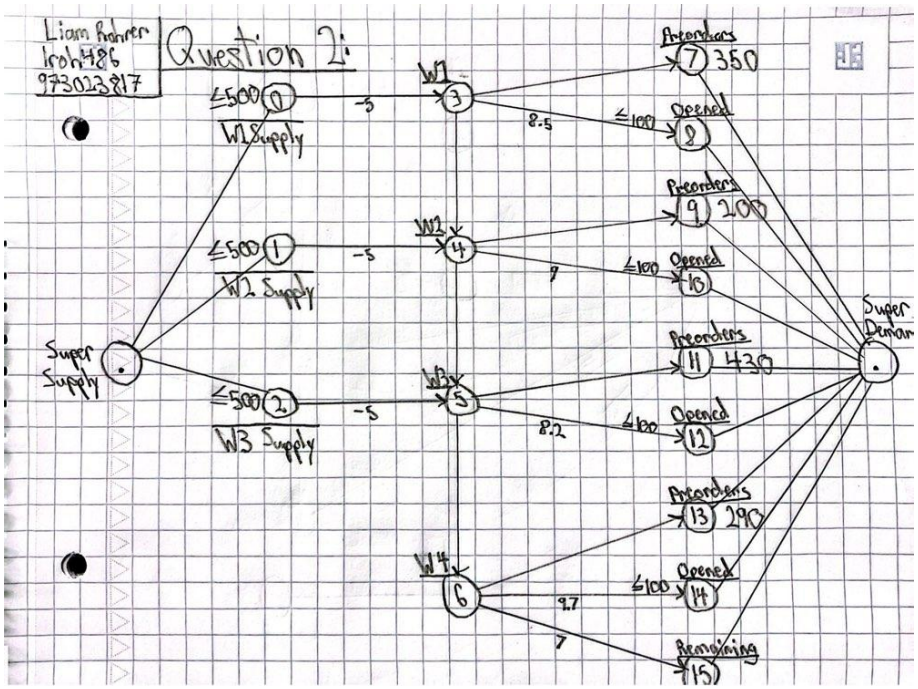
e. To account for these changes, we will need to set a constraint that at least as many Louie Mutton bags must be purchased as Louie Mutton belts, expressed as: $X_{BE\,LM} <= X_{BA\,LM}$

f. To represent this initial cost, we will need to add a binary decision variable (Z) with a $1000 cost, representing whether we purchase anything from Walenciaga. Each Walenciaga variable ($X_{i\,WA}$) will then be multiplied by Z to determine whether any of those products are able to be purchased.

g. Mount Street Bets will be looking to buy three more pairs of shoes and will be willing to pay up to $100 per pair.

2.

a.



b. We do expect the formulation to give us naturally integer solutions because the lower and upper bounds of our decision variables are integer constrained.

c. *I put $5 as the selling price of preordered packs so that my solution would represent the profit earned from everything else*

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15
FROM	0	1	2	3	3	3	4	4	4	5	5	5	6	6	6
TO	3	4	5	7	8	4	9	10	5	11	12	6	13	14	15
PROFIT	-5	-5	-5	5	8.5		5	9	0	5	8.2	0	5	9.7	7
LOWER BO	0	0	0	350	0	0	200	0	0	430	0	0	290	0	0
UPPER BO	500	500	500	350	100	999999	200	100	999999	430	100	999999	290	100	999999
FLOW	500	500	500	350	30	120	200	100	320	430	0	390	290	100	0
Total Profit	975														

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Node	Out	In	LHS		RHS
3	500	500	500	=	500
4	620	620	620	=	620
5	820	820	820	=	820
6	390	390	390	=	390

	x1	x2	x3	x4	x5	x6	x7	x8	x9	x10	x11	x12	x13	x14	x15
FROM	0	1	2	3	3	3	4	4	4	5	5	5	6	6	6
TO	3	4	5	7	8	4	9	10	5	11	12	6	13	14	15
PROFIT	-5	-5	-5	5	8.5		5	9	0	5	8.2	0	5	9.7	7
LOWER BOUND	0	0	0	350	0	0	200	0	0	430	0	0	290	0	0
UPPER BOUND	500	500	500	350	100	999999	200	100	999999	430	100	999999	290	100	999999
FLOW	500	500	500	350	30	120	200	100	320	430	0	390	290	100	0
Total Profit:	=SUMPRODUCT(C5:R5,C8:R8)														

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Node	Out	In	LHS		RHS
3	=SUMIF($C$3:$Q$3, B12,$C$8:$Q$8)	=SUMIF($C$4:$Q$4,B12,$C$8:$Q$8)	=D12	=	=C12
4	=SUMIF($C$3:$Q$3, B13,$C$8:$Q$8)	=SUMIF($C$4:$Q$4,B13,$C$8:$Q$8)	=D13	=	=C13
5	=SUMIF($C$3:$Q$3, B14,$C$8:$Q$8)	=SUMIF($C$4:$Q$4,B14,$C$8:$Q$8)	=D14	=	=C14
6	=SUMIF($C$3:$Q$3, B15,$C$8:$Q$8)	=SUMIF($C$4:$Q$4,B15,$C$8:$Q$8)	=D15	=	=C15

3. (Online Canvas Quiz)
4.

a.

In person registration rever	Bad	Average	Good
D1	60	60	60
D2	30	30	30
D3	0	0	0

Money values in 1000's

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Online registration revenue	Bad	Average	Good
D1	0	0	0
D2	15	15	15
D3	30	30	30

Registration refunds issue	Bad	Average	Good
D1	-30	0	0
D2	-15	-15	0
D3	0	0	0

Initial fixed cost	Bad	Average	Good
D1	-18	-18	-18
D2	-14	-14	-14
D3	-3	-3	-3

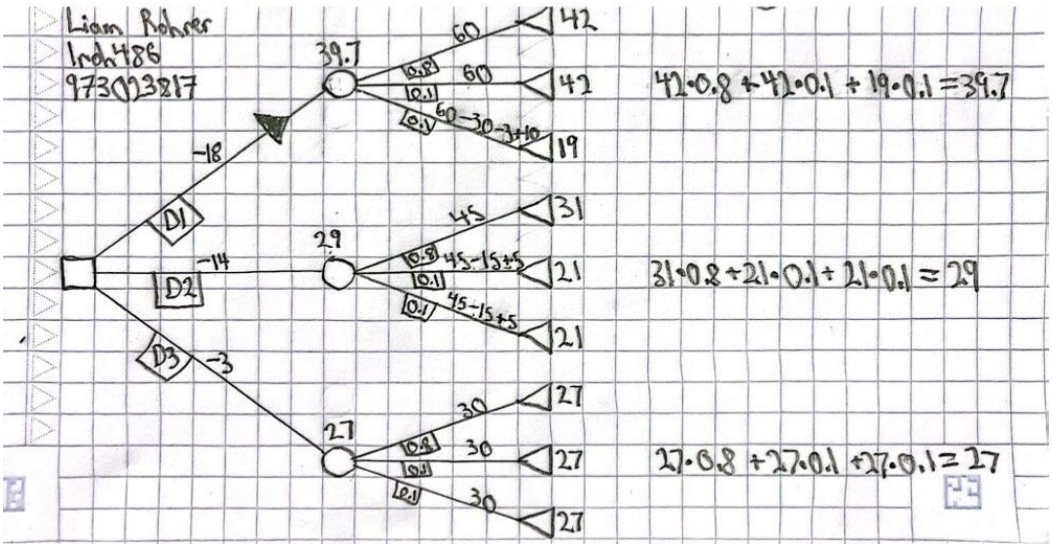
Extra fixed cost	Bad	Average	Good
D1	-3	0	0
D2	0	0	0
D3	0	0	0

Fixed cost refunded	Bad	Average	Good
D1	10	0	0
D2	5	5	0
D3	0	0	0

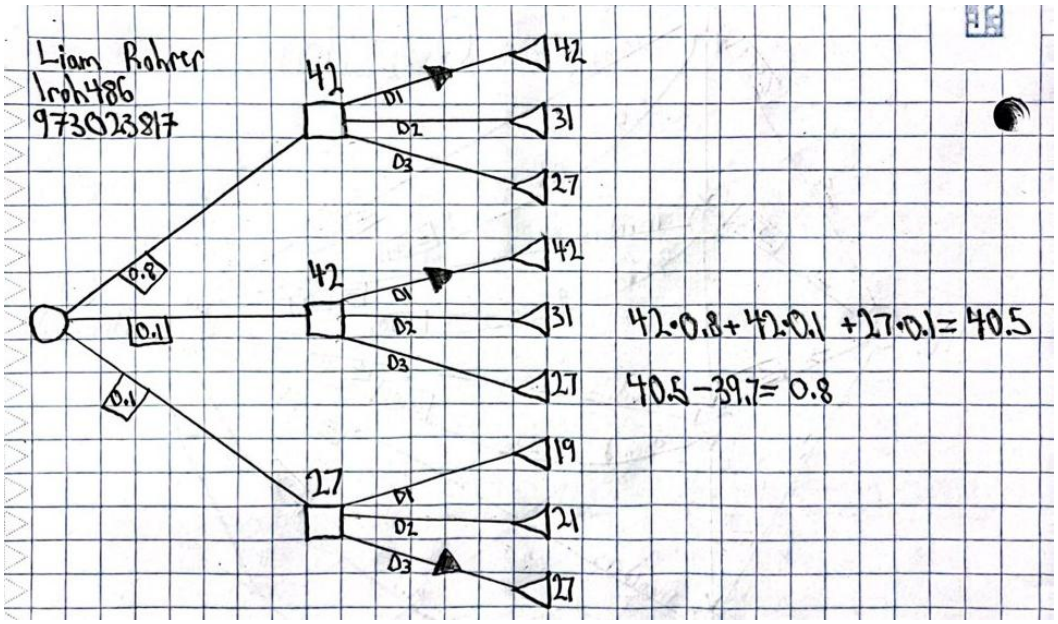
Total profit	Bad	Average	Good
D1	19	42	42
D2	21	21	31
D3	27	27	27

Regret	Bad	Average	Good	Max Regret
D1	8	0	0	8
D2	6	21	11	21
D3	0	15	15	15

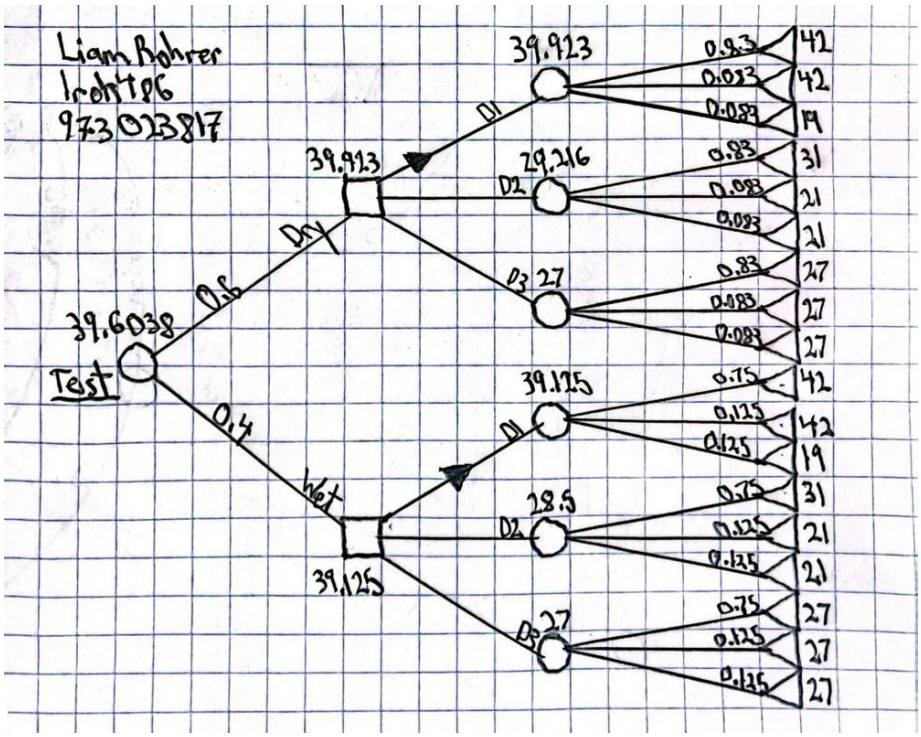
b. The best decision if the Forum is optimistic is D1 (large ship).
c. The best decision if the Forum is pessimistic is D3 (online only).
d. The best decision if the Forum wants to minimize their maximum regret is D1 (large ship) with a maximum regret of $8,000.
e. The best decision is to go with D1 which gives an expected profit of $39,700 (as shown below).



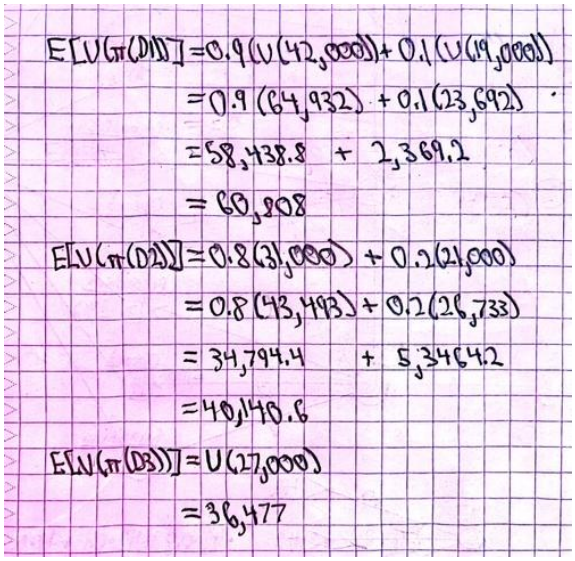
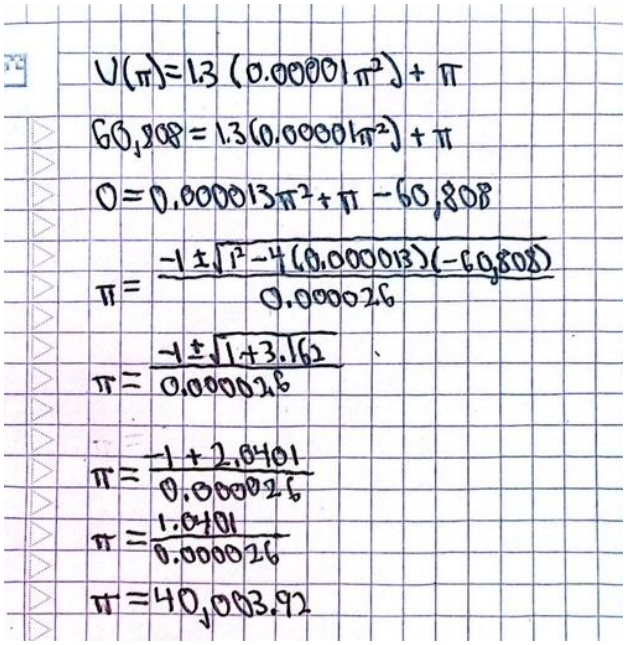
f. It would be worth us to $800 for the Forum to know the weather in advance which is shown in the decision tree below. This is known as the Expected Value of Perfect Information.



g. The forum will not be willing to pay anything for this long range weather report because the expected profit with the report ends up being slightly less than the expected profit without the report, even if the report itself is free (shown below).



h. They should choose D1 because it has the highest expected utility of at 60,808 (calculations shown below).



i. Our CEV will be 40,003.92 (working shown below)