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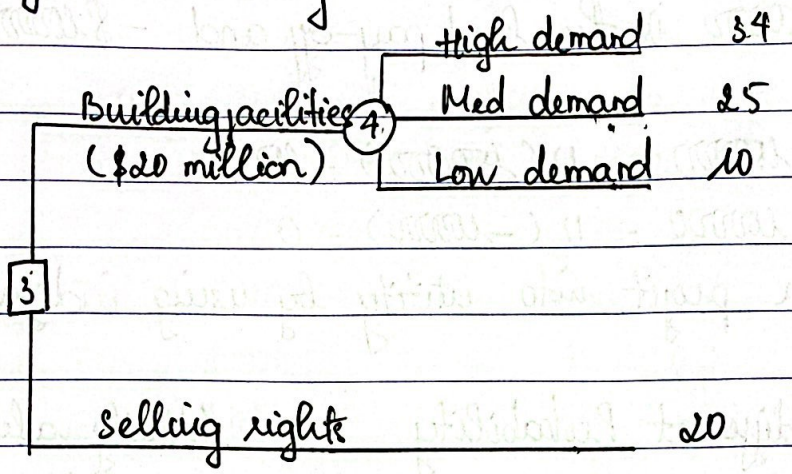
Nguyễn Thanh Thúy - 2107013.

Q1:



Pay off

Mui
10
20

Opportunity loss / regret			Max.
0	0	10	→ 10
14	5	0	→ 14

* Optimistic approach = Max {maximum} = Max {34; 20} = 34 → choose build facilities.
* Conservative approach = max {minimum} = Max {10, 10} = 20 → ___ selling rig
* Minimax regret approaches = Min {max regret decision} = min {10; 14} = 1 → choose building facilities

b) The company should under take the R&D project because the revenu which could be taken in the future if the project is successful is much higher than the loss.

* If the project is successful, the company can calculate expected value to identify the best decision alternative.

Expected value of building facilities = 34.0,5 + 25.0,4 + 10.0,10
= 28

selling rights = 20

⇒ Thus, building facilities is a recommended decision.

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Q2:

a) In this case, $150000 is the best pay-off and -$100000 is the worst

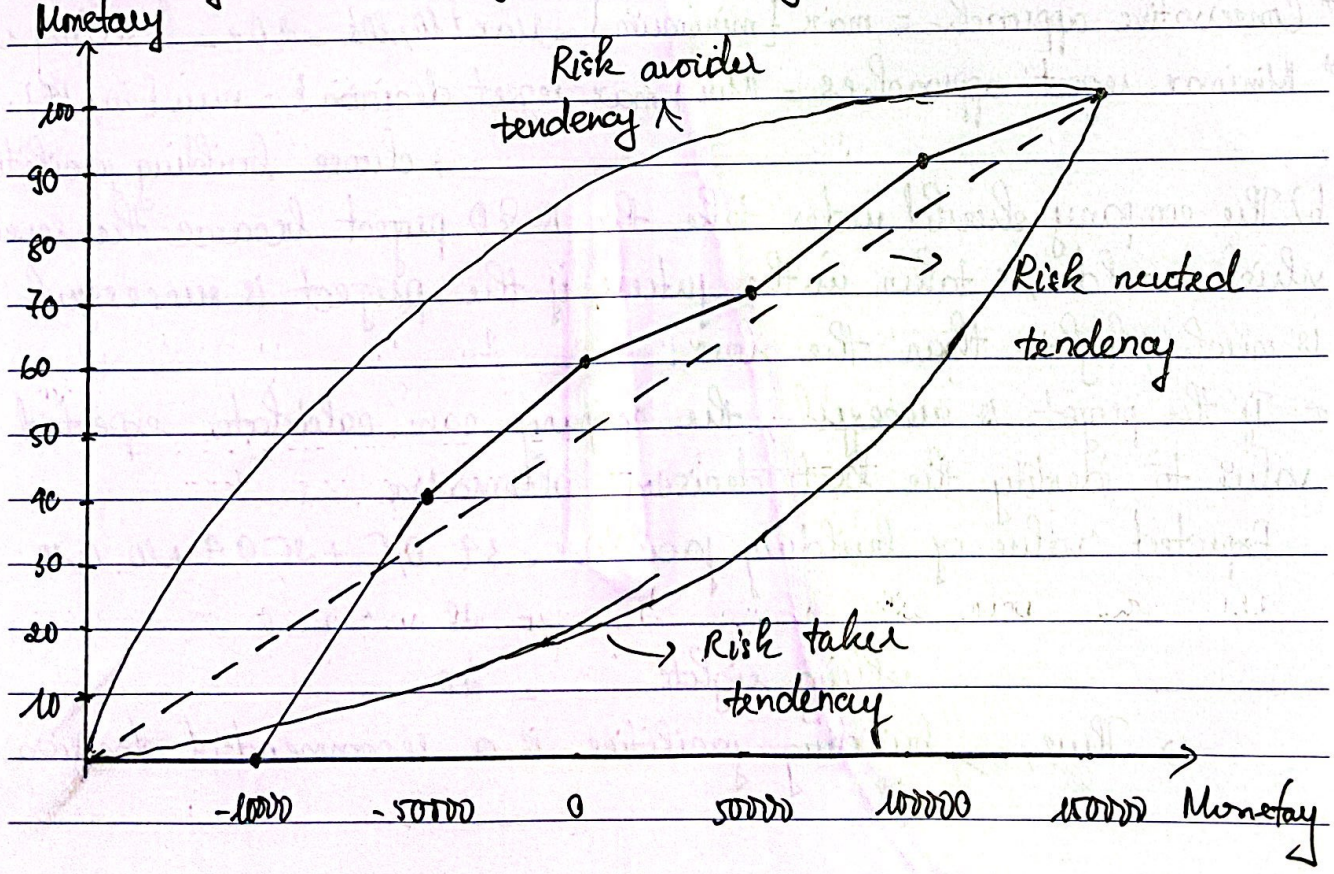
→ Utility of $150000 = U(150000) = 100

-$100000 = U(-100000) = 0.

We will convert other profit into utility by using indifferent probability:

Profit	Indifferent Probability	Utility value
$100000	0,9	90
$50000	0,7	70
$ 0	0,5	50
- $50000	0,4	40

→ From the utility table, we can identify whether the investor is a risk taker or a risk avoider by drawing a graph with 2 factors: utility and monetary.



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⇒ As can be concluded from the graph, the investor ends to be a risk neutral

* By using probability given, we can ~~conclude~~ calculate expected utility then apply expected utility approach:

EV ($150000) = 100 . 0,1 = 10

EV ($100000) = 90 . 0,1 = 9

EV ($50000) = 70 . 0,2 = 14

EV ($0) = 50 . 0,3 = 15

EV (-$50000) = 40 . 0,2 = 8

EV (-$100000) = 0 . 0,1 = 0

b) From the data of a) we can conclude: a new product has potential to make profit so investors should invest

Q3:

a) Simplify the game by applying the dominated strategy

	b_1	b_2	b_3	Minimum
a_1	0	-15	-8	-15
a_2	30	-5	5	-5
a_3	20	20	0	0 → min
maximum	30	20	5 ✓ max	

* We consider strategy a_1 and a_2, they pay off table shows that 30 > 0 (column b_1); -5 > -15 (column b_2), 5 > -8 (b_3)

→ strategy a_1 is dominated by strategy a_2 then it will be eliminated.

* Doing the same with b_1 and b_3, finding out that b_3 is dominated by b_1 ⇒ strategy b_3 will be got rid of.

Thus, the size of the game will be:

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	b_1	b_2	Minimum
a_1	30	-5	-5
a_2	20	20	(20) → min
Maximum	30	(20)	
		↓ max	

= PURE STRATEGY

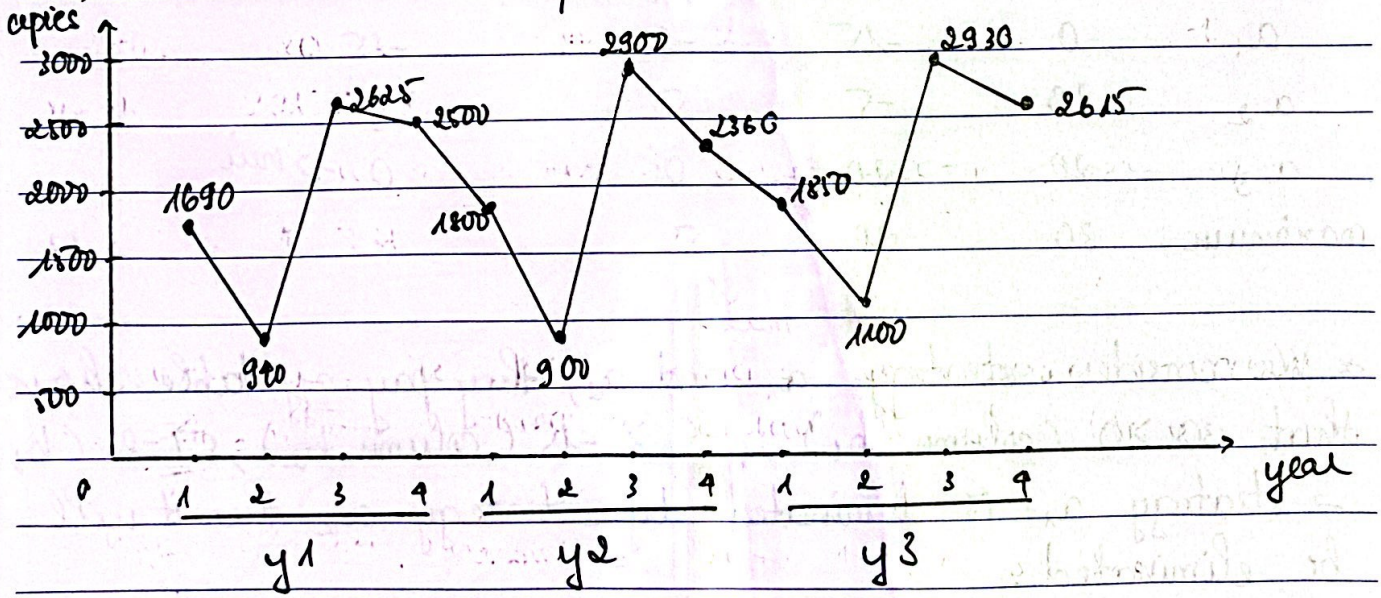
⇒ Because it is pure strategy which means no advantage could be gained by switching to a different strategy, hence:

- The republican candidate should choose strategy a_2 as the optimal strategy
- The democrat candidate should choose strategy b_2 as the optimal one

⇒ The value of the game in this case equals the value of the saddle point = 20.

Q4:

a) Construct a time series plot:



* As can be concluded from the graph, the data shows the seasonal pattern

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b) Asset the moded accuracy of the three-quater moving average forecast

Quarter	Sales	3MA forecast	Forecast error	Absolute error	Squared error	Abs (%) error
1	1690					
2	940					
3	2625					
4	2500	1752	748	748	559,504	29,92
5	1800	2022	-222	222	49,284	12,33
6	900	2308	-1408	1408	1.982.464	156,44
7	2900	1733	1167	1167	1.361.889	40,24
8	2360	1867	493	493	243.049	20,89
9	1850	2053	-203	203	41.209	10,97
10	1100	2370	-1270	1270	1.612.900	115,45
11	2930	1770	1160	1160	1345.600	39,59
12	2885	2215	400	400	160.000	15,29
Total			865	7071	7.355.899	441,12

Three-quater moving average forecast accuracy:

$MSE = \frac{7355899}{9} \approx 817,322$; $MAE = \frac{7071}{9} = 785,67$; MAPE = 49,013,

* Assets the model accuaay of an expotential smoothing forecast:

⇒ the desirable value for smoothing constant α is $\alpha = \frac{2}{12+1} = 0,154$

By using exponential smoothing constant, we can provide the forecast.

$F_{t+1} = 0,154\ Y_t + (1 - 0,154).F_t$

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Quarter	Sales	E.Sforecast	Forecast error	Absolute error	Squared error	Abs error (%)
1	1690					
2	940	1690	-750	750	562500	79,79
3	2625	1574,6	1050,38	1050,38	1103307,84	40,01
4	2500	1736,2	763,79	763,79	583375,54	30,55
5	1800	1853,7	-53,7	53,7	2885,7	2,98
6	900	1845,45	-945,45	945,45	893883,82	105,05
7	2900	1670	1200	1200	1440000,52	41,38
8	2360	1884,6	475,38	475,38	225930,706	20,14
9	1850	1957,7	-107,75	107,75	11610,35	5,82
10	1100	1941,17	-841,17	841,17	707574,03	76,47
11	2390	1811,76	578,24	578,24	334358,28	24,2
12	2615	1900,72	714,28	714,28	510192,55	27,31
					6375679,35	

Then I used excel to find α in order to minimize the mean squared error.

Choosing Data → solver → setting objective : Total squared error → to min

Secondly, choosing $\alpha = 0,154$ to change with $0 \leq \alpha \leq 1$

Subsequently, tick [V] in making unconstrained variables non-negative → select a solving method : GRG nonlinear

Eventually we find a new α as the optimal one : $\alpha = 0,066035$

$$MSE = \frac{6209640,481}{11} = 564512,8$$

$$MAPE = \frac{436}{11} = 39,64\%$$

⇒ Compare with 3quarter moving average forecast, exponential smoothing forecast with optimed value α is much more accurate

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c) Asko excel to find seasonal and trend coefficients

b_4	b_3	b_2	b_1	b_0
23,1	349,8	-1465,4	-642,3	2306,7

Then applying the following formula to find $F_1, F_2, F_3 \dots F_n$

$$F_t = b_0 + b_1 Qtr1_t + b_2 Qtr2_t + b_3 Qtr3_t + b_4 t.$$

Period	Year	Quarter	Q_1	Q_2	Q_3	Period	Y_t	f_t
1	1	1	1	0	0	1	1690	1687,5
2		2	0	1	0	2	940	887,5
3		3	0	0	1	3	2625	2725,83
4		4	0	0	0	4	2500	2399,17
5	2	1	1	0	0	5	1800	1781,67
6		2	0	1	0	6	900	980
7		3	0	0	1	7	2900	2818,33
8		4	0	0	0	8	2360	2491,67
9	3	1	1	0	0	9	1850	1872,5
10		2	0	1	0	10	1100	1072,5
11		3	0	0	1	11	2930	2910,83
12		4	0	0	0	12	2615	2584,17.