Salesforce Optimization Exercise

Part A

	Naprosyn	Nipro	Anaprox	Norinyl	Pironil	Lidex	Synalar	Nasalide
0	0.309324	0.469389	0.148199	0.309580	0.449586	0.560039	0.589636	0.156967
1	1.606966	1.524101	1.342579	1.248045	1.091816	1.202236	1.105797	1.781163
2	3.462680	2.264449	2.817291	2.618402	3.254370	2.089322	3.245910	2.045422
3	0.841761	0.825955	0.361170	0.311903	0.162404	0.394394	0.211963	0.676693

Part B

	Naprosyn	Nipro	Anaprox	Norinyl	Pironil	Lidex	Synalar	Nasalide
max-profit # salespersons: 2	270.512842	330.045573	171.686140	71.333350	36.880305	50.004889	30.654989	71.160750
objective function value: 2	221.194475	228.619794	12.951849	13.212085	26.468804	23.958271	6.168039	3.488045

{'Anaprox': {'max-profit # salespersons: 2': 171.68614043504712,
'objective function value: 2': 12.951849365862996},
'Lidex': {'max-profit # salespersons: 2': 50.0048894354598,
'objective function value: 2': 23.958271316537314},
'Naprosyn': {'max-profit # salespersons: 2': 270.51284241878415,
'objective function value: 2': 221.19447514639296},
'Nasalide': {'max-profit # salespersons: 2': 71.16075049691517,
'objective function value: 2': 3.4880449754633744},
'Nipro': {'max-profit # salespersons: 2': 330.04557310920336,
'objective function value: 2': 228.61979378077982},
'Norinyl': {'max-profit # salespersons: 2': 71.33335039916919,
'objective function value: 2': 13.212084620387422},
'Pironil': {'max-profit # salespersons: 2': 36.880305358918385,
'objective function value: 2': 26.468803646909816},
'Synalar': {'max-profit # salespersons: 2': 30.654988922303733,
'objective function value: 2': 6.168038574888255}}

Part C

{'Naprosyn': 207.3609224580993, 'Nipro': 214.46650858605594, 'Anaprox': 116.98578279777419, 'Norinyl': 45.30628561622635, 'Pironil': 27.366166689622766, 'Lidex': 33.430958714941156, 'Synalar': 22.326465021432654, 'Nasalide': 32.75690984948141}

Optimal value: 524.2537078866109

	optimal_val	max-profit # salespersons: 2	objective function value: 2	Relative decrease in SF	Relative decrease in SF %
Naprosyn	2.202570e+02	270.512842	221.194475	0.185780	18.577970
Nipro	2.459227e+02	330.045573	228.619794	0.254883	25.488269
Anaprox	1.174542e+02	171.686140	12.951849	0.315879	31.587864
Norinyl	5.153146e+01	71.333350	13.212085	0.277597	27.759656
Pironil	2.949110e+01	36.880305	26.468804	0.200356	20.035630
Lidex	3.534356e+01	50.004889	23.958271	0.293198	29.319782
Synalar	5.868277e-09	30.654989	6.168039	1.000000	100.000000
Nasalide	2.394489e-09	71.160750	3.488045	1.000000	100.000000

Naprosyn, Nipro and Pironil had relatively smaller decreases than all other drugs. This may have happened as they yield a higher return (object function is greater) than the others when compared relatively. Take Naprosyn for example, it has the least relative decrease as its objective function is much better than most. Take Synalar and Nasalide as our example, we see a tremendous decrease. This could be because the maximum profit that we can attain from either is already quite minimal (individually) and thus, they don't contribute that much to our overall profit.

Optional HW

Part (D)

	salesforce	mean	median	stddev	U1	U2	U3	U4	U5
0	100.0	235.256677	235.295992	3.989265	233.262044	231.267412	229.272779	227.278147	225.283515
1	134.0	233.624304	233.868851	4.036901	231.605853	229.587403	227.568953	225.550503	223.532052
2	168.0	231.740274	231.810880	4.317007	229.581770	227.423266	225.264762	223.106259	220.947755
3	202.0	230.147431	230.254314	3.897667	228.198597	226.249764	224.300930	222.352097	220.403263
4	236.0	227.599374	227.622198	4.133766	225.532491	223.465607	221.398724	219.331841	217.264958
5	270.0	225.584651	225.490368	3.886869	223.641216	221.697781	219.754347	217.810912	215.867477
6	304.0	223.805717	223.795329	3.941464	221.834986	219.864254	217.893522	215.922790	213.952058
7	338.0	221.607334	221.704918	4.102537	219.556065	217.504797	215.453529	213.402260	211.350992
8	372.0	219.631718	219.552766	4.092015	217.585710	215.539703	213.493695	211.447688	209.401680
9	406.0	217.904234	218.013980	4.064391	215.872039	213.839843	211.807648	209.775452	207.743256
10	440.0	216.040519	215.650955	3.979513	214.050762	212.061005	210.071249	208.081492	206.091736

Formula: $U = E(r) - 0.5*A*\text{standard-deviation}^2$
The reason why this formula has been selected is by gaining an intuition on how we can use the mean-variance portfolio theory for formulating best returns. If we look at the mean, we can think of it as the return and the variance as the expected risk. In essence, with diversification (which in our case can be construed as selecting different targets), our variance would also decrease. If we don't take this into consideration, our model would not be able to account for using lower risk to gain higher returns. These are the main reasons why this has been selected.

I would recommend to use a salesforce of 270 by considering the utility and risk aversion (through the standard deviation)

Part (F)