BEST CITIES TO LIVE & RETIRE IN USA

BIA 650-B Optimization & Process Analytics

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INTRODUCTION

Problem scenario :

- ➔ Are you retiring, going to school or looking for a fresh start ?
- ➔ How do you decide which city to live in ?
- ➔ Is it your first home , and are you looking for a good return on investment ?
- ➔ Best city rankings on the internet often don’t consider the return on investment
- ➔ What are the factors you should consider and why ?

OPTIMIZATION MODEL

Step 1: NPV Calculation and optimization

Inputs : Current house price, price after 10 years (computed using compound interest)

Decision Variables : If we should invest or not (1 or 0)

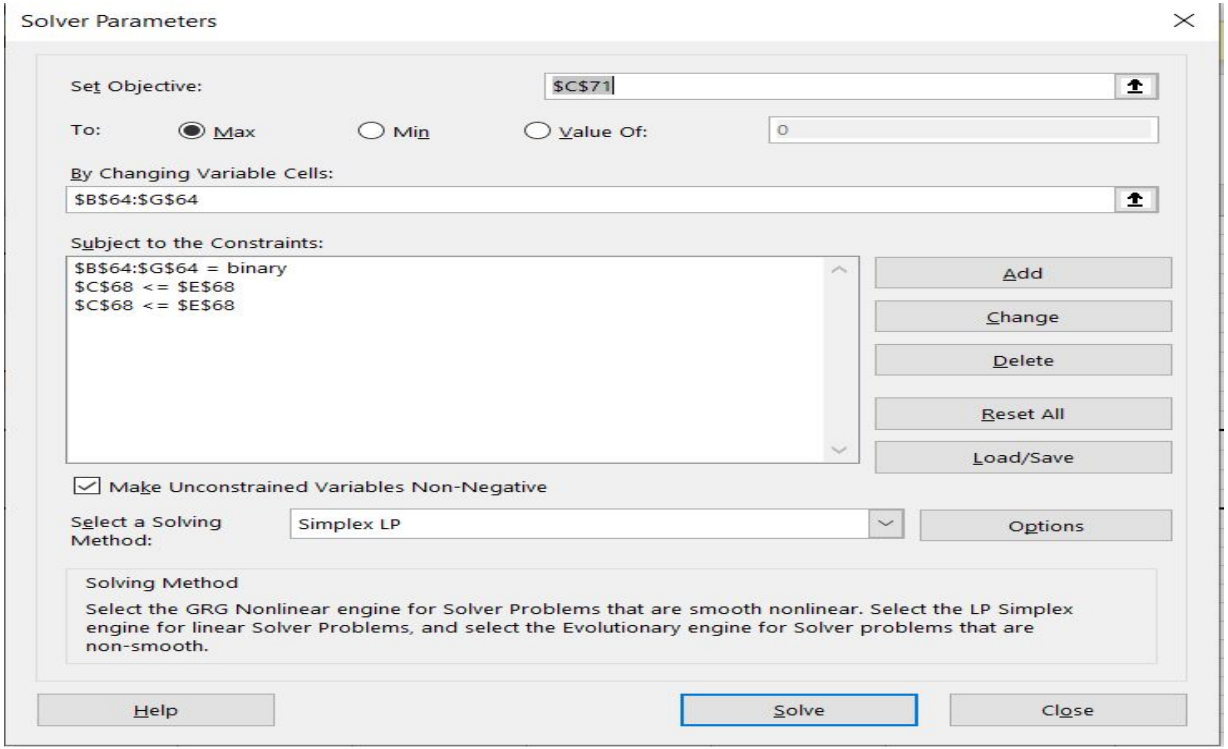
Constraints: Total money available to invest

Output: The return on investment, which is maximised. (using solver).

SPREADSHEET MODEL

Input data on potentia								
Investment	Austin, Texas	San Francisco, Cali	Seattle, Washingt	Nashville, Tennesse	New York, New Yc	Miami, Florida		
Investment cost	$384,000	$1,352,300	$718,500	$267,000	$668,500	$337,900		
Valuse after 10 years	$596,228	$1,765,133	$740,348	$328,676	$681,990	$355,180		
NPV per investment dc	1.552677083	1.305282112	1.030407794	1.230996255	1.020179506	1.05113939		
Decisions: Whether to								
Investment levels	0	1	0	1	0	1	sum	3
Budget constraint								
		Amount invested						
		$1,957,200	<=	$2,000,000				
Objective to maximize								
Total NPV		$2,448,989						

IMPLEMENTING SOLVER



GOAL PROGRAMMING

- Big cities or metropolitan, are where most people decide in USA live in.
- Most prefer to live in cities because of many jobs, shopping malls, etc.
- But we will use Goal Programming to optimize this multi-criteria decision analysis.
- We have come up with the best cities to live in, considering many factors.

ANALYTICAL HIERARCHY PROCESS

The analytic hierarchy process (AHP) is a structured technique for organizing and analyzing complex decisions, based on mathematics and psychology. Using AHP method to help people select a city that in best in terms of various criterias supplied by the decision maker.

When deciding where to put down roots, many factors are in the eye of the beholder, such as

- Objective 1: Quality of life
- **Objective 2: Return on Investment**
- Objective 3: Cost of living
- Objective 4: Safety Index
- Objective 5: Health Care Index

We used the index available to us from the following source:
https://www.numbeo.com/quality-of-life/region_rankings.jsp?title=2019-mid&region=019

A handful of cities was considered for our project including Austin, San Francisco, Seattle, Nashville, New York, and Miami.

OPTIMIZATION MODEL

STEP 1: Pairwise comparison among objectives and normalized matrix

Pariwise comparision among objectives					
	Quality of Life Index	Cost of Living	Safety Index	Health Care Index	Return on Investment
Quality of Life Index	1	4	3	5	2
Cost of Living Index	1/4	1	3/4	1 1/4	1/2
Safety Index	1/3	1 1/3	1	1 2/3	2/3
Health Care Index	1/5	4/5	3/5	1	2/5
Return on Investment	1/2	2	1 1/2	2 1/2	1

Normalized matrix					Weights
0.438	0.438	0.438	0.438	0.438	0.4379562
0.109	0.109	0.109	0.109	0.109	0.10948905
0.146	0.146	0.146	0.146	0.146	0.1459854
0.088	0.088	0.088	0.088	0.088	0.08759124
0.219	0.219	0.219	0.219	0.219	0.2189781

STEP 2: Pairwise comparison of each objective with the selected cities and their normalized matrices

Pairwise comparision among cities on Quality of Life

	Austin. Texas	San Francisco. Ca	Seattle. Washing	Nashville. Tennes	New York. New Yor	Miami. Florida
Austin. Texas	1	1.12	1.05	2.56	0.141	1.27
San Francisco. Californi	0.89	1	0.93	1	1.26	1.13
Seattle. Washington	0.95	1.06	1	1.06	0.46	1.2
Nashville. Tennessee	0.89	1	0.93	1	1.26	1.13
New York. New York	0.7	0.007	0.74	1.8	1	0.89
Miami. Florida	0.78	0.88	0.79	0.88	1.11	1

Normalized matrix

						Scores
0.19193858	0.22103809	0.193014706	0.30843370	0.02695460	0.1918429	0.1888704
0.170825336	0.197355437	0.170955882	0.12048190	0.24087170	0.1706948	0.1785308
0.182341651	0.209196763	0.183823529	0.12771080	0.08793730	0.1812688	0.1620464
0.170825336	0.197355437	0.170955882	0.12048190	0.24087170	0.1706948	0.1785308
0.134357006	0.001381488	0.136029412	0.21686740	0.19116800	0.1344410	0.1357074
0.149712092	0.173672785	0.145220588	0.10602410	0.21219650	0.1510574	0.1563139

Pairwise comparision among cities on Cost of Living Inde

	Austin. Texas	San Francisco. Ca	Seattle. Washing	Nashville. Tennes	New York. New Yor	Miami. Florida
Austin. Texas	1	0.77	0.8	1.02	0.7	0.9
San Francisco. Californi	1.28	1	1.03	1.32	0.9	1.16
Seattle. Washington	1.24	0.96	1	1.27	0.87	1.12
Nashville. Tennessee	0.97	0.75	0.78	1	0.68	0.88
New York. New York	1.42	1.11	1.14	1.47	1	1.29
Miami. Florida	1.09	0.85	0.88	1.12	0.77	1

Normalized matrix

						Scores
0.142857143	0.141544118	0.142095915	0.14166660	0.14227640	0.1417322	0.1420287
0.182857143	0.183823529	0.18294849	0.18333330	0.18292680	0.1826771	0.1830944
0.177142857	0.176470588	0.177619893	0.17638880	0.17682920	0.1763779	0.1768049
0.138571429	0.137867647	0.138543517	0.13888880	0.13821130	0.1385826	0.1384442
0.202857143	0.204044118	0.202486679	0.20416660	0.20325200	0.2031496	0.2033260
0.155714286	0.15625	0.156305506	0.15555550	0.15650400	0.1574803	0.1563016

Pairwise comparision among cities on Safety Index

	Austin. Texas	San Francisco. Ca	Seattle. Washing	Nashville. Tennes	New York. New Yor	Miami. Florida
Austin. Texas	1	1.3	1.21	1.22	1.15	1.32
San Francisco. Californi	0.77	1	0.93	0.95	0.89	1.02
Seattle. Washington	0.83	1.08	1	1.02	0.96	1.09
Nashville. Tennessee	0.82	1.05	0.98	1	0.93	1.07
New York. New York	0.87	1.12	1.04	1.07	1	1.15
Miami. Florida	0.76	0.98	0.91	0.93	0.87	1

Normalized matrix

						Scores
0.198019802	0.199081164	0.199341021	0.19709200	0.19827580	0.1984962	0.1983843
0.152475248	0.153139357	0.153212521	0.15347330	0.15344820	0.1533834	0.1531887
0.164356436	0.165390505	0.164744646	0.16478190	0.16551720	0.1639097	0.1647834
0.162376238	0.160796325	0.161449753	0.16155080	0.16034480	0.1609022	0.1612367
0.172277228	0.17151608	0.171334432	0.17285940	0.17241370	0.1729323	0.1722222
0.15049505	0.15007657	0.149917628	0.1502423	0.15	0.1503759	0.1501845

Pairwise comparision among cities on Health Care Index

	Austin. Texas	San Francisco. Ca	Seattle. Washing	Nashville. Tennes	New York. New Yor	Miami. Florida
Austin. Texas	1	0.97	0.97	1.14	1.07	1.11
San Francisco. Californi	1.02	1	1	1.18	1.1	0.11
Seattle. Washington	1.02	1	1	0.11	1.1	0.11
Nashville. Tennessee	0.87	0.84	0.84	1	0.93	0.09
New York. New York	0.92	0.9	0.9	0.09	1	1.03
Miami. Florida	0.9	0.87	0.87	1.03	1.8	1

Normalized matrix

						Scores
0.17452007	0.173835125	0.173835125	0.25054940	0.07631950	0.1079766	0.1595059
0.178010471	0.17921147	0.17921147	0.25934060	0.07845930	0.0107003	0.1474889
0.178010471	0.17921147	0.17921147	0.02417580	0.07845930	0.0107003	0.1082948
0.151832461	0.150537634	0.150537634	0.21978020	0.06633380	0.0087548	0.1246294
0.160558464	0.161290323	0.161290323	0.01978020	0.07132660	0.1001945	0.1124067
0.157068063	0.155913978	0.155913978	0.22637360	0.12838800	0.0972762	0.1534889

Pairwise comparision among cities on Return on Investm

	Austin. Texas	San Francisco. Ca	Seattle. Washing	Nashville. Tennes	New York. New Yor	Miami. Florida
Austin. Texas	1	1.19	1.5	1.261	1.52	1.47
San Francisco. Californi	0.84	1	1.26	1.06	1.27	1.24
Seattle. Washington	0.66	0.79	1	0.83	1	0.98
Nashville. Tennessee	0.79	0.94	1.19	1	1.2	1.17
New York. New York	0.66	0.78	0.99	0.8	1	0.97
Miami. Florida	0.68	0.8	1.02	0.85	1.03	1

Normalized matrix

						Scores
0.215982721	0.216363636	0.215517241	0.21737630	0.21652420	0.2152269	0.2161651
0.181425486	0.181818182	0.181034483	0.18272710	0.18091160	0.1815519	0.1815781
0.142548596	0.143636364	0.143678161	0.14307870	0.14245010	0.1434846	0.1431461
0.17062635	0.170909091	0.170977011	0.17238400	0.17094010	0.1713030	0.1711899
0.142548596	0.141818182	0.142241379	0.13790720	0.14245010	0.1420205	0.1414976
0.146868251	0.145454545	0.146551724	0.14652640	0.14672360	0.1464128	0.1464229

STEP 3: Determining the ranking of the cities and best of them and comparing to the results

Determining best city								
Matrix of scores						Weighted scores	Ranking	Business Insider Score
City	Quality of Life Index	Cost of Living Index	Safety Index	Health Care Index	Return on Investment			
Austin, Texas	0.188870451	0.142028758	0.198384362	0.159505995	0.216165178	0.1885	1	1
San Francisco, California	0.178530862	0.183094415	0.153188701	0.147488967	0.181578154	0.1733	2	7
Seattle, Washington	0.162046494	0.176804908	0.164783418	0.108294828	0.143146112	0.1552	4	9
Nashville, Tennessee	0.178530862	0.138444257	0.161236714	0.124629437	0.171189962	0.1653	3	15
New York, New York	0.135707417	0.203326041	0.172222219	0.11240676	0.141497676	0.1477	6	
Miami, Florida	0.156313914	0.156301621	0.150184586	0.153488988	0.146422919	0.1530	5	

OUTPUT:

Considering all the factors of Quality of life, Cost of Living, Safety Index, Healthcare Index and Return on Investment, we can see that **Austin, Texas** is ranked No. 1 on the list, following with San Francisco, California.

CONCLUSION

- To make the top of the list, a place had to have good value, be a desirable place to live, have a strong safety index and a high quality of life.

- From the optimization models, Austin in Texas is considered by far to be the best city to live and retire in considering all the factors like quality of life, safety, healthcare, return on investment.

- Additionally, Austin also gives us the best value on investment. People should consider these factors as critical while deciding on a city to get what they expect and will eventually increase the overall quality of their life.

REFERENCES

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