

Data 618 Portfolio Management Project

CUNY SPS MSDS

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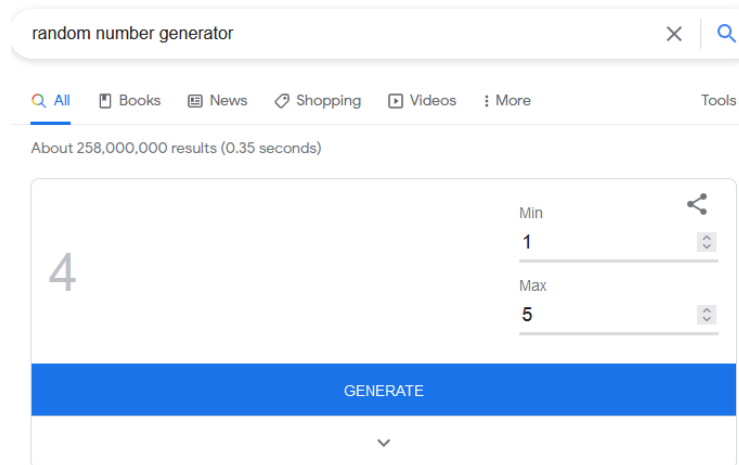
Fall 2022

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Scenario

Using the random number generator from Google, we are assigned scenario number 4.

A screenshot of Google's random number generator interface. At the top, there is a search bar with the text "random number generator" and a magnifying glass icon. Below the search bar, there are tabs for "All", "Books", "News", "Shopping", "Videos", and "More". The "All" tab is selected. Below the tabs, it says "About 258,000,000 results (0.35 seconds)". The main area shows a large number "4" on the left. On the right, there are two input fields: "Min" with the value "1" and "Max" with the value "5". Below these fields is a blue button labeled "GENERATE". At the bottom, there is a small downward arrow icon.

You are a 55-year-old painting contractor. You and your spouse own you home on which there is a mortgage balance of \$262,000. Your savings account balance is \$6,000 and you have no other investments. You have three children ages 16, 13 and 9. GREAT NEWS; you have just one the state lottery and have opted for a one time cash payout that will amount to \$ 125 M.

Assumptions

Based on the information, we make the following assumptions:

- Assume that I am a risk averse person since I didn't put any savings in investments.
- As a risk averse person, I would calculate my future expenses conservatively with a 5% inflation rate.
- Assuming I am living in New York, the tax rates for lottery are 25% for the Federal Tax and 8.82% for the State Tax. The after-tax income from the lottery is \$82.725 M.
- Based on the salary for painting contractor reported on comparably.com (Appendix A), assume that my annual salary is \$100K. This number is a little higher than the average \$94K considering that I am a senior painting contractor.
- Assume that my wife has the same age, 55.
- Assume that my wife has similar earning, which is \$100K annually.
- For a household income of \$200K, the total of after-tax income is \$140K.
- My wife and me resign from our jobs immediately.
- Assume that all my children are going to attend college at age 17.

- I would like to guarantee that my children would have enough fund to attend the best schools in the United States. According to the article [10 Most, Least Expensive Private Colleges](#), the annual cost for the most expensive colleges is about \$65K (Appendix B).
- Assume that I bought my house one year before my first child was born, which is 2005. Based on themortgagereports.com, the average 30-year mortgage rate in 2005 is 5.87% (Appendix C).
- Since I had made some savings, assume that my household earning was just enough for the living of my family with a mortgage.
- I would like to guarantee that I can maintain the same or somewhat better lifestyle for the rest of my life. Assume that my wife and me will live up to age 100.

Future Expenses

With the assumptions, we project that I will have the following expenses in the future:

- \$262K mortgage balance.
- Starting \$210K (50% increase to the original after-tax income 140K for a better lifestyle) per year with 5% increasement per year as cost-of-living adjustment. The total is \$35.424M
- \$294K starting 1 year after, \$341K starting 4 years after, and \$414K starting 8 years after for the college expenses for my children. The total is \$1049K. The numbers are calculated using the annual expense of \$65K per student with a 5% inflation rate.
- Additionally, I would like to reserve \$2M for each of my children to cover full or partial expenses of buying their own house or higher education after they finish their undergraduate college degrees.

My total of cash is \$82,731,000 (\$82,725,000 + \$6,000). As a risk averse person, I would like to pay off my mortgage (\$262,000) since the interest rate is high as 5.87%. I also keep \$210,000 for this year's living. The remaining balance is \$ 82,259,000. The total of expected future expenses (excluding the \$210,000 living cost of this year) is \$42,263,000.

Putting all the information together, we would put \$42,263,000 in risk-free assets such as the U.S. 30 Year Treasury bond. The remaining balance can be invested in equities, hoping to leave a great wealth for my descendants. We will invest \$23,997,600 (60% of the remaining \$39,996,000) in common stocks and \$15,998,400 (40% of the remaining \$39,996,000) in ETFs. ETFs are less risky than individual stocks as themselves are diversified portfolios.

Selection of Stocks

To build a diversified portfolio, we would select one stock from each of the sectors categorized on [tradingview](#), except the Finance sector. We would like to exclude the Finance sector since we

are at the risk of a global recession as warned by the [World Bank](#) and [FedEx CEO, Raj Subramaniam](#). When recession turns into crisis, the Finance sector is the first one to fail. We may adjust our portfolio later as we are getting more confident that the recession is coming. Below are the sectors listed on tradingview. For details about the industries in each sector, please see Appendix D.

- COMMERCIAL SERVICES
- COMMUNICATIONS
- CONSUMER DURABLES
- CONSUMER NON-DURABLES
- CONSUMER SERVICES
- DISTRIBUTION SERVICES
- ELECTRONIC TECHNOLOGY
- ENERGY MINERALS
- FINANCE
- HEALTH SERVICES
- HEALTH TECHNOLOGY
- INDUSTRIAL SERVICES
- MISCELLANEOUS
- NON-ENERGY MINERALS
- PROCESS INDUSTRIES
- PRODUCER MANUFACTURING
- RETAIL TRADE
- TECHNOLOGY SERVICES
- TRANSPORTATION
- UTILITIES

Within each sector, we find the common stock with the highest sharpe ratio and PE no greater than 25. The sharpe ratio is calculated using the daily return from 9/17/2021 to 9/16/2022 and the annual yield 3.144% of the U.S. 3 Month Treasury Bill as the risk-free rate. The PE threshold of 25 is used to make sure that overvalued stocks are not selected. We didn't use the returns before 9/17/2021 since it may be inappropriate to use data during the pandemic to measure the post-pandemic performance.

The selected stocks are:

Ticker	Sector	PE	Mean_Return	Volatility	Sharpe_Ratio
HSN	COMMERCIAL SERVICES	11.24	0.00392791	0.04209888	0.09037236
GOGO	COMMUNICATIONS	6.28	0.00106926	0.04076846	0.02320222
JAKK	CONSUMER DURABLES	4.11	0.00365815	0.04901952	0.07211032
CALM	CONSUMER NON-DURABLES	20.99	0.00205731	0.01941468	0.09961384
HRB	CONSUMER SERVICES	12.99	0.00261198	0.02432359	0.10231403

HDSN	DISTRIBUTION SERVICES	3.92	0.00451732	0.05088229	0.08635579
BELFA	ELECTRONIC TECHNOLOGY	11.45	0.00313749	0.03115059	0.09676053
ARLP	ENERGY MINERALS	10.69	0.00408066	0.03052002	0.12966326
CI	HEALTH SERVICES	17.11	0.00151138	0.01648320	0.08420955
SRTS	HEALTH TECHNOLOGY	8.97	0.00719350	0.05395194	0.13104561
LNG	INDUSTRIAL SERVICES	NA	0.00288781	0.02360956	0.11709114
BSM	MISCELLANEOUS	14.22	0.00163013	0.02146100	0.07021069
HUDI	NON-ENERGY MINERALS	NA	0.01085824	0.08137554	0.13191808
CF	PROCESS INDUSTRIES	8.21	0.00321401	0.02948030	0.10483846
CSL	PRODUCER MANUFACTURING	21.27	0.00167321	0.01821836	0.08507222
MUSA	RETAIL TRADE	13.04	0.00222219	0.01998012	0.10504722
AZPN	TECHNOLOGY SERVICES	NA	0.00259436	0.02434602	0.10149600
ASC	TRANSPORTATION	NA	0.00498289	0.03725396	0.13044399
ED	UTILITIES	21.66	0.00122489	0.01256987	0.08763457

We will allocate \$23,997,600 evenly in each of above stocks.

Selection of ETFs

We select 10 ETFs with the highest sharpe ratio. The sharpe ratios are calculated using the same method in the stock selection.

Ticker	Type	Mean_Return	Volatility	Sharpe_Ratio
YCS	ETF	0.00210010	0.01190423	0.16605530
UUP	ETF	0.00065341	0.00459329	0.11540155
EUO	ETF	0.00132254	0.01070854	0.11198599
EWV	ETF	0.00248633	0.02292244	0.10308659
DIG	ETF	0.00434383	0.04144332	0.10183765
TTT	ETF	0.00356777	0.03420061	0.10071253
ERX	ETF	0.00430671	0.04205064	0.09948424
TMV	ETF	0.00354277	0.03451068	0.09908324
TBT	ETF	0.00238588	0.02284666	0.09903149
TYO	ETF	0.00174704	0.01658487	0.09790240

We will allocate \$15,998,400 evenly in each of above ETFs.

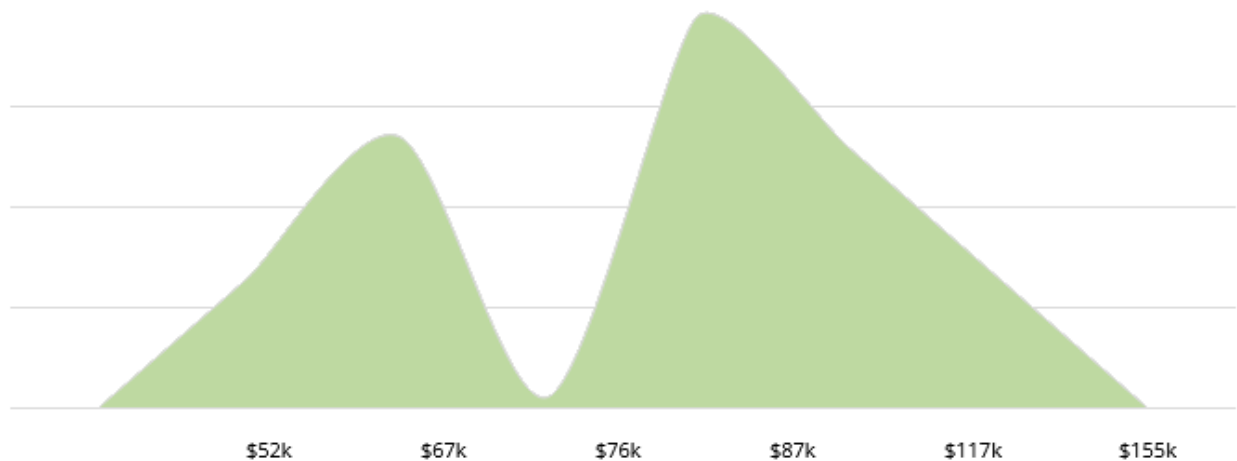
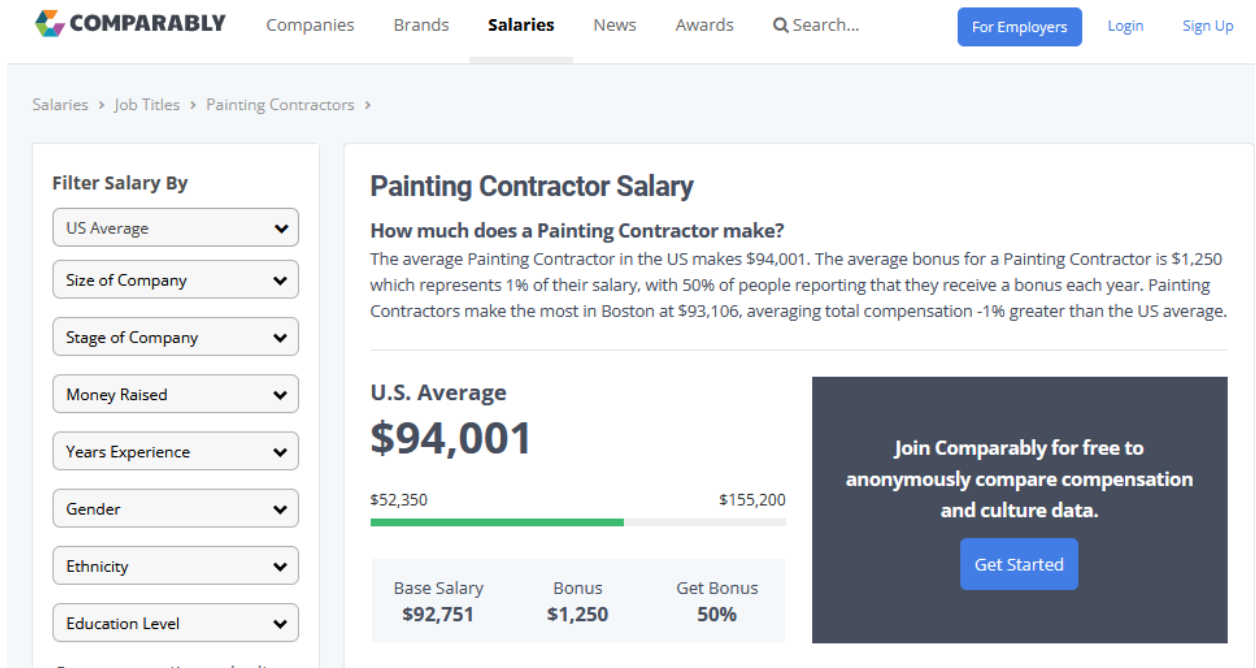
Final Investment Allocation

The following is the summary of our investment fund allocation as the assets are purchased using the closing price on 9/16/2022.

Ticker	Type	Sector	Price	Units	Amount
US30Y	U.S. 30 Year Treasury	NA	\$90.44	467317.00	\$42,262,981.19
HSO	Common Stock	COMMERCIAL SERVICES	\$34.95	36138.24	\$1,263,031.49
GOGO	Common Stock	COMMUNICATIONS	\$13.32	94822.19	\$1,263,031.57
JAKK	Common Stock	CONSUMER DURABLES	\$23.37	54044.99	\$1,263,031.42
CALM	Common Stock	CONSUMER NON-DURABLES	\$56.85	22216.91	\$1,263,031.33
HRB	Common Stock	CONSUMER SERVICES	\$44.93	28111.09	\$1,263,031.27
HDSN	Common Stock	DISTRIBUTION SERVICES	\$7.94	159071.98	\$1,263,031.52
BELFA	Common Stock	ELECTRONIC TECHNOLOGY	\$28.52	44285.81	\$1,263,031.30
ARLP	Common Stock	ENERGY MINERALS	\$23.88	52890.76	\$1,263,031.35
CI	Common Stock	HEALTH SERVICES	\$290.35	4350.03	\$1,263,031.21
SRTS	Common Stock	HEALTH TECHNOLOGY	\$14.80	85339.97	\$1,263,031.56
LNG	Common Stock	INDUSTRIAL SERVICES	\$167.25	7551.75	\$1,263,030.19
BSM	Common Stock	MISCELLANEOUS	\$15.70	80447.87	\$1,263,031.56
HUDI	Common Stock	NON-ENERGY MINERALS	\$29.64	42612.40	\$1,263,031.54
CF	Common Stock	PROCESS INDUSTRIES	\$98.59	12810.95	\$1,263,031.56
CSL	Common Stock	PRODUCER MANUFACTURING	\$291.30	4335.84	\$1,263,030.19
MUSA	Common Stock	RETAIL TRADE	\$276.88	4561.65	\$1,263,029.65
AZPN	Common Stock	TECHNOLOGY SERVICES	\$226.37	5579.50	\$1,263,031.42
ASC	Common Stock	TRANSPORTATION	\$10.00	126303.15	\$1,263,031.50
ED	Common Stock	UTILITIES	\$97.41	12966.13	\$1,263,030.72
YCS	ETF	NA	\$63.33	25261.96	\$1,599,839.93
UUP	ETF	NA	\$29.40	54416.32	\$1,599,839.81
EUO	ETF	NA	\$33.42	47870.73	\$1,599,839.80
EWV	ETF	NA	\$20.04	79832.33	\$1,599,839.89
DIG	ETF	NA	\$36.04	44390.67	\$1,599,839.75
TTT	ETF	NA	\$67.66	23645.28	\$1,599,839.64
ERX	ETF	NA	\$54.51	29349.47	\$1,599,839.61
TMV	ETF	NA	\$119.12	13430.49	\$1,599,839.97
TBT	ETF	NA	\$29.35	54509.02	\$1,599,839.74
TYO	ETF	NA	\$12.52	127782.74	\$1,599,839.90

Appendix

A. Painting Contractor Salary



Salary Ranges for Painting Contractors

The salaries of Painting Contractors in the US range from \$52,350 to \$155,200 , with a median salary of \$87,400 . The middle 50% of Painting Contractors makes \$76,000, with the top 83% making \$155,200.

B. Schools Expenses

Most Expensive Schools

SCHOOL NAME (STATE)	2022-2023 TUITION AND FEES	U.S. NEWS RANK AND CATEGORY
Kenyon College (OH)	\$66,490	31 (tie), National Liberal Arts Colleges
Franklin & Marshall College (PA)	\$65,844	39 (tie), National Liberal Arts Colleges
Tufts University (MA)	\$65,222	32, National Universities
Brown University (RI)	\$65,146	13 (tie), National Universities
Colorado College	\$65,028	27 (tie), National Liberal Arts Colleges
Vassar College (NY)	\$64,800	13 (tie), National Liberal Arts Colleges
University of Southern California	\$64,726	25 (tie), National Universities
Colgate University (NY)	\$64,290	16 (tie), National Liberal Arts Colleges
Boston College	\$64,176	36 (tie), National Universities
Amherst College (MA)	\$64,100	2, National Liberal Arts Colleges

C. Mortgage Rates

Year	Average 30-Year Rate	Year	Average 30-Year Rate	Year	Average 30-Year Rate
1974	9.19%	1990	10.13%	2006	6.41%
1975	9.05%	1991	9.25%	2007	6.34%
1976	8.87%	1992	8.39%	2008	6.03%
1977	8.85%	1993	7.31%	2009	5.04%
1978	9.64%	1994	8.38%	2010	4.69%
1979	11.20%	1995	7.93%	2011	4.45%
1980	13.74%	1996	7.81%	2012	3.66%
1981	16.63%	1997	7.60%	2013	3.98%
1982	16.04%	1998	6.94%	2014	4.17%
1983	13.24%	1999	7.44%	2015	3.85%
1984	13.88%	2000	8.05%	2016	3.65%
1985	12.43%	2001	6.97%	2017	3.99%
1986	10.19%	2002	6.54%	2018	4.54%
1987	10.21%	2003	5.83%	2019	3.94%
1988	10.34%	2004	5.84%	2020	3.10%
1989	10.32%	2005	5.87%	2021	2.96%

Source: Freddie Mac

D. Sectors and Industries

- **COMMERCIAL SERVICES**
 - Advertising/Marketing Services
 - Commercial Printing/Forms
 - Financial Publishing/Services
 - Miscellaneous Commercial Services
 - Personnel Services
- **COMMUNICATIONS**
 - Major Telecommunications
 - Specialty Telecommunications
 - Wireless Telecommunications
- **CONSUMER DURABLES**
 - Automotive Aftermarket
 - Electronics/Appliances
 - Home Furnishings
 - Homebuilding
 - Motor Vehicles
 - Other Consumer Specialties
 - Recreational Products
 - Tools & Hardware
- **CONSUMER NON-DURABLES**
 - Apparel/Footwear
 - Beverages: Alcoholic
 - Beverages: Non-Alcoholic
 - Consumer Sundries
 - Food: Major Diversified
 - Food: Meat/Fish/Dairy
 - Food: Specialty/Candy
 - Household/Personal Care
 - Tobacco
- **CONSUMER SERVICES**
 - Broadcasting
 - Cable/Satellite TV
 - Casinos/Gaming
 - Hotels/Resorts/Cruise lines
 - Media Conglomerates
 - Movies/Entertainment
 - Other Consumer Services
 - Publishing: Books/Magazines
 - Publishing: Newspapers
 - Restaurants

- DISTRIBUTION SERVICES
 - Electronics Distributors
 - Food Distributors
 - Medical Distributors
 - Wholesale Distributors
- ELECTRONIC TECHNOLOGY
 - Aerospace & Defense
 - Computer Communications
 - Computer Peripherals
 - Computer Processing Hardware
 - Electronic Components
 - Electronic Equipment/Instruments
 - Electronic Production Equipment
 - Semiconductors
 - Telecommunications Equipment
- ENERGY MINERALS
 - Coal
 - Integrated Oil
 - Oil & Gas Production
 - Oil Refining/Marketing
- FINANCE
 - Finance/Rental/Leasing
 - Financial Conglomerates
 - Insurance Brokers/Services
 - Investment Banks/Brokers
 - Investment Managers
 - Life/Health Insurance
 - Major Banks
 - Multi-Line Insurance
 - Property/Casualty Insurance
 - Real Estate Development
 - Real Estate Investment Trusts
 - Regional Banks
 - Savings Banks
 - Specialty Insurance
- HEALTH SERVICES
 - Hospital/Nursing Management
 - Managed Health Care
 - Medical/Nursing Services
 - Services to the Health Industry
- HEALTH TECHNOLOGY
 - Biotechnology
 - Medical Specialties

- Pharmaceuticals: Generic
 - Pharmaceuticals: Major
 - Pharmaceuticals: Other
- INDUSTRIAL SERVICES
 - Contract Drilling
 - Engineering & Construction
 - Environmental Services
 - Oil & Gas Pipelines
 - Oilfield Services/Equipment
- MISCELLANEOUS
 - Investment Trusts/Mutual Funds
 - Miscellaneous
- NON-ENERGY MINERALS
 - Aluminum
 - Construction Materials
 - Forest Products
 - Other Metals/Minerals
 - Precious Metals
 - Steel
- PROCESS INDUSTRIES
 - Agricultural Commodities/Milling
 - Chemicals: Agricultural
 - Chemicals: Major Diversified
 - Chemicals: Specialty
 - Containers/Packaging
 - Industrial Specialties
 - Pulp & Paper
 - Textiles
- PRODUCER MANUFACTURING
 - Auto Parts: OEM
 - Building Products
 - Electrical Products
 - Industrial Conglomerates
 - Industrial Machinery
 - Metal Fabrication
 - Miscellaneous Manufacturing
 - Office Equipment/Supplies
 - Trucks/Construction/Farm Machinery
- RETAIL TRADE
 - Apparel/Footwear Retail
 - Catalog/Specialty Distribution
 - Department Stores
 - Discount Stores

- Drugstore Chains
 - Electronics/Appliance Stores
 - Food Retail
 - Home Improvement Chains
 - Internet Retail
 - Specialty Stores
- TECHNOLOGY SERVICES
 - Data Processing Services
 - Information Technology Services
 - Internet Software/Services
 - Packaged Software
- TRANSPORTATION
 - Air Freight/Couriers
 - Airlines
 - Marine Shipping
 - Other Transportation
 - Railroads
 - Trucking
- UTILITIES
 - Alternative Power Generation
 - Electric Utilities
 - Gas Distributors
 - Water Utilities