

HOMEWORK 2, Due May 6, 2021, before class (100 points)

Problem statements that seem clear to one person may not be clear to another and it is difficult to fully specify all details and notes that could prevent you from interpreting this problem differently than intended. If you need clarification, please post to Piazza or contact the instructor or TA.

Please submit the assignment as a single PDF file – preferably not handwritten – with any code (not required) as appendix material.

1. In the table below are the allocations from funds of major, but undisclosed U.S. fund distributors.

		Fund 1.1	Fund 1.2	Fund 1.3	Fund 1.4
Fund Company 1	Large Cap	42.40%	33.17%	23.09%	17.69%
	Mid Cap	2.85%	2.23%	1.55%	1.19%
	Small Cap	1.23%	0.96%	0.67%	0.51%
	EAFE	27.25%	21.31%	14.84%	11.37%
	EM	9.46%	7.40%	5.15%	3.95%
	Global Bond	2.52%	5.25%	8.22%	9.80%
	Total US Bond	14.20%	29.61%	46.40%	55.30%
	Cash	0%	0.07%	0.08%	0.19%
		Fund 2.1	Fund 2.2	Fund 2.3	Fund 2.4
Fund Company 2	Domestic Stock	52.30%	43.60%	39.70%	26.40%
	Foreign Stock	26.70%	21.40%	20.10%	13.40%
	Preferred Stock	0.20%	0.00%	0.20%	0.10%
	Convertibles	0.50%	0.30%	0.60%	0.50%
	Other	5%	2.70%	5.80%	5.80%
	Foreign Bond	3.90%	3.20%	10.40%	16.10%
	Domestic Bond	9.70%	28.70%	19.60%	26.90%
	Cash	1.70%	0.10%	3.60%	10.80%
		Fund 3.1	Fund 3.2	Fund 3.3	Fund 3.4
Fund Company 3	Domestic stock	58%	58%	38%	49%
	Foreign Stock	1%	22%	11%	18%
	Asset Backed Security	3%	1%	3%	2%
	Foreign Corp Bond	1%	1%	3%	2%
	Mortgage Backed	9%	1%	2%	1%
	US Corp Bond	9%	4%	9%	6%
	Foreign Govt Bond		2%	7%	3%
	US Govt Bond	17%	7%	22%	13%
	Cash	1%	3%	6%	5%

Discuss in no more than 2 paragraphs how these allocations are consistent with or inconsistent with CAPM

2. Mean Absolute Deviation considers the expected deviation of the portfolio's return from its expected return. Compared with portfolio variance, it is less strongly impacted by outliers and can be modeled through linear relationships.

If portfolio returns x are normally distributed (i.e. have a pdf of the form

$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}(\frac{x-\mu}{\sigma})^2}$), prove that $E[|x - \mu|] = \kappa\sigma$ where κ is a constant.

3. You are considering portfolios that can be constructed from three investments, A, B and C. The expected returns, standard deviations and correlations of the normally distributed returns of the investments are shown in the table below.

Expected Returns	Standard Deviations	Correlations		
		A	B	C
13%	20%	1.0	0.6	0.5
10%	18%	0.6	1.0	0.3
8%	12%	0.5	0.3	1.0

Develop a mean-MAD frontier and compare it to a mean-variance frontier for the same return assumptions.

Plot both frontiers and compare the optimal portfolio weights. Please provide a brief discussion of key similarities and differences.