

Homework 3

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Instructions

Submit your assignment as a PDF or Word document to Canvas by **Friday Sept 29 at 7:00PM**. It is your responsibility to follow the homework guidelines on Canvas and ensure that the file you upload is complete and uncorrupted.

Grading

A small number of the problems on each assignment will be graded for correctness, and the remainder graded for completeness. A complete response answers the question posed and also shows your work. This means showing the steps of a mathematical calculation, or including the R code you used to arrive at your answer. For questions that are not just calculations (e.g., more than computing an expected value from a table) you should answer in complete, concise sentences. Detailed solutions will be available – you should always check your work against these solutions.

Problem 1 (12 points)

Suppose Z has a standard normal distribution: $Z \sim N(0, 1)$. Compute i-iv, and answer v-vi.

- (i) $\Pr(Z \geq 2.5)$
- (ii) $\Pr(0.1 < Z < 1)$
- (iii) $\Pr(0.1 < Z \leq 1)$
- (iv) $\Pr(-1.5 \leq Z \leq 2.5)$
- (v) What is the distribution of $3Z + 2$? (Hint: Linear combinations of normal random variables are normal random variables...)
- (vi) Suppose U is another standard normal random variable independent of Z . What is the distribution of $4U - 2Z + 1$?

Problem 2 (12 points)

$X \sim N(5, 10)$ (Read: X has a normal distribution with mean 5 and variance 10) Compute:

- (i) $\text{Prob}(X > 5)$
- (ii) $\text{Prob}(X > 5 + 2 \times \sqrt{10})$

- (iii) Prob ($X = 8$)
- (iv) Express Prob($-2 \leq X \leq 6$) in terms of Z , the standard normal random variable.
- (v) Prob ($X > 7$)
- (vi) Find the value of q such that $\Pr(X > q) = 0.75$

Problem 3 (6 points)

A company can purchase raw material from either of two suppliers and is concerned about the amounts of impurity the material contains. A review of the records for each supplier indicates that the percentage impurity levels in consignments of the raw material follow normal distributions with the means and standard deviations given in the table below. The company is particularly anxious that the impurity level in a consignment not exceed 5% and want to purchase from the supplier more likely to meet that specification. Which supplier should be chosen?

	Mean	Standard Deviation
Supplier A	4.4	0.4
Supplier B	4.2	0.6

Problem 4 (20 points)

In class (slides 26-30 in Section 1.3) we looked at modeling portfolios of SP500 and bonds. Under the models give there,

1. (4 pts) Compute the Sharpe ratios (assuming risk-free returns of 2%) for holding only SP500, only bonds, or the 70% SP500/30% bond portfolio. Based on this criterion, which would you prefer?
2. (8 pts) Compute the mean and the variance for a portfolio that is 25% SP500 and 75% bonds. What is its Sharpe ratio?
3. (4 pts) For each of the four investments (only SP500, only bonds, 70% SP500/30% bonds, 25% SP500/75% bonds) compute the probability that the returns after one year exceed 2%.
4. (4pts) For each of the four investments (only SP500, only bonds, 70% SP500/30% bonds, 25% SP500/75% bonds) find the value such that the returns are greater than that value with probability 0.1