# *THE CO-OPERATIVE UNIVERSITY OF KENYA*

**END OF SEMESTER EXAMINATION DECEMBER -2022**

**EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN FINANCE (YR III SEM I)**

**UNIT CODE: BECO 3101**

**UNIT TITLE: FINANCIAL ECONOMETRICS I**

**DATE: FRIDAY, 23RD DECEMBER, 2022**

**TIME: 9:00 AM – 11:00 AM**

**INSTRUCTIONS:**

- **Answer question ONE (compulsory) and any other TWO questions**

**QUESTION ONE**

(a) A bank has issued loans to 60 customers. Based on past experience, the bank expects 10% of the customers to default.

**Required:** Calculate the expected number of defaults and the standard deviation of the number of defaults (5 marks)

(b) Ali manages a portfolio of 250 stocks. He draws a sample of 50 stocks, which has a standard deviation of returns of 15% and a mean annual return of 20%. Calculate the standard error of the sample mean (5 marks)

(c) Suppose the prospects for recovering principal for a defaulted bond issue depend on which of two economic scenarios prevails.

- Scenario 1 has probability 0.75 and will result in recovery of Sh 0.90 per Sh1 principal value with probability of 0.45, or in recovery of Sh 0.80 per Sh 1 principal value with probability 0.55
- Scenario 2 has probability 0.25 and will result in recovery of Sh 0.50 per Sh 1 principal value with probability 0.85, or in recovery of Sh 0.40 per Sh 1 principal value with probability 0.15

**Required:**

**i.** Compute the probability of each of the four possible recovery amounts: Sh 0.90, Sh 0.80, Sh 0.50 and Sh 0.40 (3 marks)

**ii.** Compute the expected recovery, given the first scenario (3 marks)

**iii.** Compute the expected recovery, given the second scenario. (3 marks)

**iv.** Compute the expected recovery. (3 marks)

**v.** Graph the information in a tree diagram (3 marks)

(d) Ali manages a portfolio of 250 stocks. He draws a sample of 50 stocks, which has a standard deviation of returns of 15% and a mean annual return of 20%. Calculate the standard error of the sample mean (5 marks)

**QUESTION TWO**

(a) Suppose we have the expected daily returns (in-terms of U.S. dollars), standard deviations and correlations shown in the table below.

| **U.S., German, and Italian Bond Returns** | | | |
|---|---|---|---|
| **U.S. Dollar Daily Returns in Percent** | | | |
| | U.S. Bonds | German Bonds | Italian Bonds |
| Expected return | 0.029 | 0.021 | 0.073 |
| Standard Deviation | 0.409 | 0.606 | 0.635 |
| **Correlation Matrix** | | | |
| | U.S. Bonds | German Bonds | Italian Bonds |
| U.S. Bonds | 1 | 0.09 | 0.10 |
| German Bonds | | 1 | 0.70 |
| Italian Bonds | | | 1 |

**Required:**

i. Using the data given above, construct a covariance matrix for the daily return on U.S., German, and Italian bonds. (3 marks)

ii. State the expected return and variance of return on a portfolio 70% invested in U.S. bonds, 20% in German Bonds and 10% in Italian bonds (3 marks)

iii. Calculate the standard deviation of return for the portfolio in Part b) (3 marks)

(b) Explain any **FIVE** the properties of normal distribution (7 marks)

The variance of a stock portfolio depends on the variance of each individual stock in the portfolio and also the covariance's among the stocks in the portfolio. If you have five stocks, how many unique covariance's (excluding variances) must you use in order to compute the variance of return on your portfolio? (4 marks)

**QUESTION THREE**

(a) You have developed a set of criteria for evaluating distressed credits. Companies that do not receive a passing score are classed as likely to go bankrupt within months. You gathered the following information when validating the criteria:

- Forty percent of the companies to which the test is administered will go bankrupt within months: p(nonsurvivor)=0.40.
- Fifty-five percent of the companies to which the test is administered pass it: P(pass test)=0.55.
- The probability that a company will pass the test given that it will subsequently survive 12 months, is 0.85: P(pass test | survivor)=0.85.

**Required:**

i. What is P(pass test | nonsurvivor)? (3 marks)

ii. Using Bayes' formula, calculate the probability that a company is a survivor, given that it passes the test (calculate P(survivor | pass test). (3 marks)

iii. What is the probability that a company is a nonsurvivor, given that it fails the test? (3 marks)

iv. Is the test effective? (3 marks)

(b) On one day in June 3,292 issues traded on the NYSE: 1,303 advanced, 1,764 declined and 225 were unchanged. In how many ways could this set of outcomes have happened? (3 marks)
(c) Your firm intends to select 4 of 10 vice presidents for the investment committee. How many different groups of four are possible? (3 marks)
(d) Define the term "binomial random variable". Describe the types of problems for which the binomial distribution is used. (2 marks)

**QUESTION FOUR**

Over the last 10 years, a company's annual earnings increased year over year seven times and decreased year over year three times. You decide to model the number of earnings increases for the next decade as a binomial random variable.

(a) What is your estimate of the probability of success, defined as an increase in annual earnings? (3 marks)

For parts B, C, and D of this problem, assume the estimated probability is the actual probability for the next decade.

(b) What is the probability that earnings will increase in exactly 5 of the next 10 years?
(c) Calculate the expected number of yearly earnings increases during the next 10 years (3 marks)
(d) Calculate the variance and standard deviation of the number of yearly earnings increases during the next 10 years. (3 marks)

(e) The expression for the probability function of a binomial random variable depends on two major assumptions. In the context of this problem, what must you assume about annual earnings increases to apply the binomial distribution in part B? What reservations might you have about the validity of these assumptions? (3 marks)

(f) You are forecasting sales for a company in the fourth quarter of its fiscal year. Your low-end estimate of sales is 14 million and your high-end estimates is 15 million. You decide to treat all outcomes for sales between these two values as equally likely, using a continuous uniform distribution.

**i.** What is the expected value of sales for the fourth quarter? (3 marks)
**ii.** What is the probability that fourth-quarter sales will be less than or equal to 14,125,000? (5 marks)

**QUESTION FIVE**

(a) Why is the central limit theorem important? (5 marks)

Willco is a manufacturer in a mature cyclical industry. During the most recent industry cycle, its net income averaged 30 million per year with a standard deviation of 10 million (n=6 observations). Management claims that Willco's performance during the most recent cycle results from new approaches and that we can dismiss profitability expectations based on its average or normalized earnings of 24 million per year in prior cycles.

(a) With μ as the population value of mean annual net income, formulate null and alternative hypotheses consistent with testing Willco management's claim (3 marks)
(b) Assuming that Willco's net income is at least approximately normally distributed, identify the appropriate test statistic. (3 marks)

(c) Identify the rejection point or points at the 0.05 level of significance for the hypothesis tested in Part A. (3 marks)

(d) Determine whether or not to reject the null hypothesis at the 0.05 significance level (3 marks)