Strathmore
UNIVERSITY

STRATHMORE BUSINESS SCHOOL

MASTER OF SCIENCE IN DEVELOPMENT FINANCE

END OF SEMESTER EXAMINATION

MDF 8103: QUANTITATIVE METHODS IN DEVELOPMENT FINANCE

Date: Friday 13th December 2024 **Time: 3** Hours

Instructions

1. This examination consists of **FIVE** questions.
2. Answer **QUESTION ONE** and **ANY OTHER THREE** questions.

Question 1 (Compulsory) (30 Marks)

(a) Suppose you work in Human Resource department. You plan to survey employees to find their average medical expenses. You want to be 95% confident that the sample mean is within ± $50. A pilot study showed that sample standard deviation was about $400. Determine the sample size that would be adequate for this survey. **(3 Marks)**

(b) A local superstore reviewed its credit card policy with the intention of recalling some of its credit cards. In the past, approximately 5 per cent of the card holders defaulted, leaving the superstore unable to collect the outstanding balance. Hence management established a prior probability of 0.05 that any particular card holder will default. The superstore also found out that the probability of missing a monthly payment is 0.20 for customers who do not default. Of course the probability of missing a monthly payment for those who default is 1.

(i) Given that clients missed one or more monthly payments, determine the posterior probability that the customer will default. **(4 Marks)**

(ii) The superstore would like to recall its card if the probability that a patient will default is greater than 0.20. Should the superstore recall its card if the customer misses a monthly payment? **(2 Marks)**

(c) *Investment risk analysis:* The risk portfolio of financial assets is sometimes called *investment risk*. In general, investment risk is typically measured by computing the variance or standard deviation of the probability distribution that describes the decision maker's potential outcomes

(gains or losses). The two discrete probability distributions given below were developed from historical data. They describe the potential total physical damage losses next year to the fleets of delivery trucks of two different firms.

Firm A		Firm B	
Loss next year ($)	Probability	Loss next year ($)	Probability
0	0.1	0	0.00
500	0.1	200	0.01
1000	0.2	700	0.3
1500	0.3	1200	0.15
2000	0.3	1700	0.45

(i) Determine the expected total physical damage for both firms **(4 Marks)**

(ii) Compute the standard deviation for each probability distribution and determine which firm faces the greatest risk of physical damage to its fleet next year **(5 Marks)**

(d) The descriptive statistics for weekly wages (in hundred Kshs) of 100 company employees are given below:

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                Total
Variable        Count    Mean  StDev    Minimum  Q1    Median   Q3
weekly wages      100   32.83  10.12      15.00  25.00   31.50  41.75

Variable        Maximum  Kurtosis
weekly wages    54.00     -0.77
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(i) Develop the 95% and 99% confidence intervals for the mean weekly wages. Interpret both the intervals **(4 Marks)**

(ii) Suppose the board of directors recommend salary increments for these workers. Which confidence level would you recommend when implementing this recommendation? Why? **(2 Marks)**

(e) A real estate developer has a piece of land adjacent to a larger tract of land that is soon to be zoned for industrial, office park, or residential use. She must decide how to develop the property before the zoning decision for the larger tract is made. She can develop the property store (A_1), a restaurant (A_2) or a service station (A_3). The following gives probabilities and the net realizable profit over the next 5 years.

Event	Probability	Acts($)		
		A_1	A_2	A_3
Industrial park	0.25	10,000	18,000	25,000
Office park	0.25	10,000	50,000	15,000
Residential	0.50	60,000	15,000	20,000

Using Expected Opportunity Loss criteria, determine the optimal act **(6 Marks)**

Question 2 (10 Marks)

(a) A manufacturing company is planning to market a new product. According to the financial analysis, it will earn an annual profit of $ 4.5 million if this product has high sales, annual profit

of $ 1.2 million if the sales are average and it will lose $ 2.3 million a year if the sales are low. The probabilities of these three scenarios are 0.32, 0.51 and 0.17 respectively. Suppose the profits earned is designated by a random variable X,

(i) Construct a probability distribution table for above problem **(1 Mark)**

(ii) Determine the expected profits **(2 Marks)**

(iii) Determine the variance of $Y = 3X + 4$ **(3 Marks)**

(b) A financial analyst of an insurance company has established that the average commission charged by full service brokerage firms on a sale of common stock is $ 84, and standard deviation is $ 10. Janet has taken a random sample of 75 traders by her clients and determined that they paid an average commission of $ 81.50. At 0.10 significance level, can Janet conclude that her clients' commissions are higher than the industry average? **(4 Marks)**

Question 3 (10 Marks)

Almost all companies utilize some type of year-end performance review for their employees. Human Resource (HR) at an audit firm provides guidelines for supervisors rating their subordinates. For example, raters are advised to examine their ratings for a tendency to be either too lenient or too harsh. According to HR, "If you have this tendency, consider using a normal distribution; rate 10% of employees as exemplary, 20% distinguished, 40% competent, 20% marginal, and 10% unacceptable." Suppose you are rating an employee's performance on a scale of 1 (lowest) to 100 (highest). Also, assume the ratings follow a normal distribution with a mean of 50 and a standard deviation of 15

(a) Determine the lowest rating you would give to an "exemplary" employee if you follow the rating guidelines **(5 Marks)**

(b) Determine the highest rating you would give to a "competent" employee if you follow the rating guidelines **(5 Marks)**

Question 4 (10 Marks)

The Sports department of a local University is considering whether to hold an extensive campaign next year to raise funds for a new athletic field. The response to the campaign depends heavily upon the success of the football team this season. In the past, the football team has had winning seasons 60 percent of the time. If the football team has a winning season (W) this term, then many alumni will contribute and the campaign will raise $ 3 million. If the team has a losing season (L), few will contribute and the campaign will lose $2 million. If no campaign is undertaken, no costs are incurred. On September 1st, just before the football season begins, the athletics department needs to make its decision about whether to hold the campaign next year.

Suppose in similar situations in the past, when evaluating teams that have a winning season 50% of the time, the predictions of James, who is a football guru, have been correct 75% of the time. Considering that this team has more of a winning tradition, if James predicts a winning season.

(i) Draw the decision tree for this entire problem. **(5 Marks)**

(ii) Analyse this decision tree to determine the optimal policy regarding whether to undertake the campaign. **(5 Marks)**

Question 5 (10 Marks)

*Buy-side Vs Sell side analysts' earnings forecasts***.** The *Financial Analysts Journal* (July/August 2008) did a study of earnings forecasts of buy-side and sell-side analysts. Buy-side analysts differ

from sell-side analysts on a variety of factors, including scope of industry coverage, sources of information used and target audience. Data were collected on 3,526 forecasts made by buy-side analysts and 58,562 forecasts made by sell-side analysts, and the relative absolute forecast error was determined for each. A positive forecast error indicates that the analyst is overestimating earnings, while a negative forecast error implies that the analyst is underestimating earnings. Summary statistics for the forecast errors in the two samples are given in the table below.

	Buy-side Analysts	Sell-side Analysts
Mean	0.85	-0.05
Standard deviation	1.93	0.85

Test whether there is any significant difference between the buy-side analysts and sell-side analysts at 0.05 level. **(5 Marks)**

(b) *The Pepsi challenge.* "Take the Pepsi challenge" was a famous marketing campaign used by Pepsi-Cola company. Coca-Cola drinkers participated in a blind taste test where they were asked to taste unmarked cups of Pepsi and Coke and were asked to select their favorite. In one Pepsi television commercial, an announcer stated that "in recent blind taste tests, more than half the Diet Coke drinkers surveyed said they preferred the taste of Diet Pepsi." Suppose 100 Diet Coke drinkers took the Pepsi Challenge and 56 preferred the taste of the Diet Pepsi.

(i) Carry out a hypothesis test at 0.05 level to determine if more than half of all Diet Coke drinkers selected Diet Pepsi in the blind taste test **(4 Marks)**

(ii) Explain the consequences of the test results from Coca-Cola's perspective. **(1 Mark)**

Question 6 (10 Marks)

(a) A manufacturing company developed the following estimated regression equation relating sales to inventory investment and advertising expenditures.

$$\hat{y} = 25 + 10x_1 + 8x_2$$

where $x_1 =$ inventory investment ($1000s)

$x_2 =$ advertising expenditures ($1000s)

$y =$ sales ($1000s)

(i) Estimate the sales resulting from $15,000 investment in inventory and an advertising budget of $10,000 **(1 Mark)**

(ii) Interpret β_1 and β_2 in this estimated regression equation **(2 Marks)**

(b) The following *Minitab* output shows the regression analysis of data on ages and incomes of random sample of executives working for a large multinational company, and the number of years each went to college:

Regression Analysis: Age (x1) versus Years in college (x2), Income ($)

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The regression equation is
Age (x1) = 8.56 - 3.05 Years in college (x2) + 0.000510 Income ($)


Predictor                   Coef     SE Coef       T      P
Constant                  8.5607      0.6783   12.62  0.006
Years in college (x2)    -3.04673     0.03503  -86.97  0.000
Income ($)             0.00050963  0.00000917   55.56  0.000


S = 0.120886   R-Sq = 100.0%   R-Sq(adj) = 99.9%


Analysis of Variance

Source          DF       SS      MS        F      P
Regression       2  113.171  56.585  3872.16  0.000
Residual Error   2    0.029   0.015
Total            4  113.200
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(i) Write the regression equation **(1 Mark)**

(ii) Determine the sample size for each data set used in the survey **(1 Mark)**

(iii) Explain the meaning of the coefficients in the model **(3 Marks)**

(iv) Interpret the meaning of the R-square above **(1 Mark)**

(v) Write down the null hypothesis and make your conclusions on the fit of the model. **(1 Mark)**