



MACHAKOS UNIVERSITY

University Examinations for 2022/2023 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (ACTUARIAL SCIENCE)

SAC 204: RISK MANAGEMENT

DATE: 18/4/2023

TIME: 11:00 – 1:00 PM

INSTRUCTIONS

ANSWER QUESTION ONE [COMPUSLSORY] AND TWO OTHER QUESTIONS

QUESTION ONE: (30 MARKS)

- a) Define the following terms:
- i. Risk financing. (2 marks)
 - ii. Pearson's Rho. (2 marks)
- b) State three types of organizational risk. (3 marks)
- c) Loss controls refers to efforts that reduce expected losses .Mention three types of loss controls. (3 marks)
- d) A risk treatment plan specifies how an organization will implement treatments to ensure understanding and to monitor effectiveness .outline five specifications. (5 marks)
- e) A compound distribution S is such that $P(N = 0) = 0.6$, $P(N = 1) = 0.3$ and $P(N = 2) = 0.1$. Claim amounts are either 1 unit or 2 units each with probability 0.5. Derive the distribution function of S . (5 marks)

- f) Given the table below, compute Kendall's Tau. (5 marks)

t	X _t	Y _t	V _{S_t=1}	V _{S_t=2}	V _{S_t=3}	V _{S_t=4}	V _{S_t=5}	V _{S_t=6}
1	30	20						
2	35	30	C(+,+)					
3	40	40	D(+,-)	C(-,-)				
4	45	50	D(+,-)	C(-,-)	C(+,+)			
5	50	60	C(+,+)	D(+,-)	C(+,+)	C(+,+)		
6	55	70	C(-,-)	C(+,+)	D(+,-)	D(+,-)	C(+,+)	C(+,+)

- g) Given that $p_k = \text{Prob}\{X = k\}$, $q_k = \text{Prob}\{Y = k\}$ for $k = 0, 1, 2, \dots$
 Suppose $Z = X + Y$ and $r_k = \text{Prob}\{Z = k\}$ where X and Y are independent discrete random variable .Show that; (5 marks)

$$r_k = \sum_{r=0}^k p_k q_{k-r}$$

QUESTION TWO (20 MARKS)

- a) Discuss five challenges faced in risk management. (5 marks)
- b) Project R delegates all the development work to outside companies. The estimated cash flows for project R are: (last column indicates expenditure)

Beginning of year 1	150,000 dollars	Contractor fees
Beginning of year 2	250,000 dollars	Contractor fees
Beginning of year 3	250,000 dollars	Contractor fees
End of year 3	1,000,000 dollars	Sales

Table 1

Project S carries out all the development work in-house by purchasing the necessary equipment and using the company's own staff. The cash flows for the project S are: (last column indicates expenditure)

Beginning of year 1	325,000 dollars	New equipment
Throughout year 1	75,000 dollars	Staff cost
Throughout year 2	90,000 dollars	Staff cost
Throughout year 3	120,000 dollars	Staff cost
End of year 3	1,000,000 dollars	Sales

Table 2

The staff cost can be estimated to be paid uniformly throughout the year.

- a) Evaluate the NPV for the project R and S using a risk discount rate of 10% pa? **(13 marks)**
- b) Using the NPV as a criterion, which project is preferable? **(2 marks)**

QUESTION THREE (20 MARKS)

- a) Explain three risks that captives can be used to finance under tailored insurance coverage. **(6 marks)**
- b) S.W.O.T analysis is one of the best known techniques for strategy development and risk identification. Mention some of the potential factors that are in this tool. **(14 marks)**

QUESTION FOUR (20 MARKS)

Moody's Analytics Inc. has hired you as a risk analyst.

- a) Given the table below, demonstrate how you would analysis risk based on Pearson's Rho. **(17 marks)**

t	X_t	Y_t
1	20	30
2	105	35
3	25	20
4	45	25
5	55	40

- b) Mention three measures you will consider while controlling the risks. **(3 marks)**

QUESTION FIVE (20 MARKS)

- a) If $X \sim \text{Poisson}(\lambda)$ and $Y \sim \text{Poisson}(\mu)$ are independent random variables, find the probability function of $Z = X + Y$ using convolution. **(10 marks)**
- b) You have been assigned the task of evaluating and managing risk in a given organization. Explain the methods that you would consider while assessing the effect of implementing controls. **(10 marks)**