

# Kathmandu University

## Course of study

**Course Title:** Probability and Statistics  
**Course Code:** AIMA 102

**Level:** Undergraduate  
**Credit:** 3

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**Group:** B.Tech in Artificial Intelligence (I Year - I Semester)

**Total Lecture Hours:** 45

### Course Description:

This syllabus is aimed at giving knowledge of application of probability and statistical methods in AI field. This course covers concept of descriptive statistics, probability, random variables, univariate and bivariate probability distribution, sampling theory and statistical inference, correlation and regression.

### Objectives:

Statistical methods are required to analyze patterns and attributes present in data. Artificial intelligence is related to gaining knowledge from available data to make decisions about the present and forecast future. In this regard this syllabus is aimed at giving knowledge of application of probability and statistical methods in the artificial intelligence field.

### Evaluation Scheme:

In-semester evaluation - 25 marks

- Assignment - 5 marks
- Internal Tests - 20 marks

End-semester evaluation - 75 marks

- 20 marks for objective (10 Q  $\times$  1 = 10 marks for 'fill-in-blank' and 10 Q  $\times$  1 = 10 marks for multiple choice questions)
- 55 marks for subjective (Long answer questions- 3 Q  $\times$  7 = 21 marks, Short answer questions - 6 Q  $\times$  4 = 24 marks, Very short answer questions - 5 Q  $\times$  2 = 10 marks)

### Course Contents

#### Unit 1: Descriptive Statistics [6 Hrs.]

Numerical representation of data

- Revision of mean, median, mode, quartiles, range, quartile deviation, mean deviation, standard deviation, coefficient of variation
- Moments

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Approved Date: September 2, 2021

- Skewness- Pearson's coefficient of skewness, Bowley's coefficient of skewness, Skewness based on moments
- Kurtosis- Kurtosis based on moments

Graphical representation of data

- Dot plot
- Stem-and-Leaf plot
- Box plot

## **Unit 2: Probability [6 Hrs.]**

- Some terms- random experiment, sample space, trial, event.
- Simple probability, Compound probability
- Mutually exclusive events, Addition theorem
- Independent events, Multiplication theorem
- Dependent events, Conditional probability
- Partitions, Total probability law
- Bayes' theorem and its application in AI

## **Unit 3: Random Variables [6 Hrs.]**

- Introduction
- Probability mass function
- Probability density function
- Cumulative distribution function
- Expectation and variance of random variables

## **Unit 4: Univariate Probability Distributions [6 Hrs.]**

- Binomial distribution
- Multinomial distribution
- Normal distribution
- Central limit theorem

## **Unit 5: Bivariate Probability Distributions [7 Hrs.]**

- Joint probability mass function, Joint probability density function, Joint cumulative distribution function
- Marginal probability mass function, Marginal probability density function, Marginal cumulative distribution function
- Conditional probability mass function, Conditional probability density function, Conditional cumulative distribution function
- Conditional expectation

### **Unit 6: Sampling Theory and Statistical Inference [8 Hrs.]**

- Introduction of terms- population, sample, sampling, parameter, statistic, inference
- Sampling distribution of sample means
- Parameter estimation- Confidence interval for mean of normal population (population variance known case only)
- Hypothesis testing - Test of hypothesis on mean of normal population (population variance known case only)
- p-Value and its significance in statistical analysis

### **Unit 7: Correlation and Regression [6 Hrs.]**

- Simple correlation (Pearson's correlation coefficient)
- Simple linear regression
- Prediction, error in prediction, principle of least square

### **Text Books**

1. Probability and Statistics in Engineering (4th Edition) - W. Hines, D. Montgomery, D. Goldsman, C. Borror- Wiley Publication
2. Introduction to Probability and Statistics for Engineers and Scientists (3rd Edition) - Sheldon M. Ross, Elsevier Academic Press.