

Specific Elements of the Competency (*in italics*)

Standard of Performance: The student must be able to:

1. *To correctly incorporate the concepts of probability in the decision-making process.*

1.1 PROBABILITY

- 1.1.1 explain the meaning of: outcome; equally likely outcomes; event; sample space.
- 1.1.2 calculate probabilities and be able to explain the basic properties of a probability distribution.
- 1.1.3 apply the rules of probability to calculate probabilities of compound events.
- 1.1.4 calculate joint and marginal probabilities.
- 1.1.5 calculate conditional probability.
- 1.1.6 explain the difference between dependent and independent events.
- 1.1.7 apply Bayes' theorem. (optional)

1.2. PERMUTATIONS AND COMBINATIONS

- 1.2.1 demonstrate an understanding of the Fundamental Counting Principle.
- 1.2.2 know the formulas for nPr and nCr and use them to solve problems.
- 1.2.3 use the Binomial Theorem to expand $(p+q)^n$ where n is a positive integer.

2. *To correctly use the various probability distributions in the decision-making process.*

2.1 DISCRETE RANDOM VARIABLES

- 2.1.1 explain the meaning of: random variable; discrete random variable.
- 2.1.2 recognize a discrete random variable and determine its probability distribution.
- 2.1.3 be able to calculate the mean (expected value) and standard deviation of a random variable.
- 2.1.4 state and use the properties of expected value and variance.
- 2.1.5 calculate probabilities and solve problems concerning linear combinations of random variables.
- 2.1.6 calculate probabilities and know the expected values and variance for binomial distributions (Poisson optional).

3. *To standardize data.*

3.1 CONTINUOUS RANDOM VARIABLES

- 3.1.1 explain the meaning of: continuous random variable, normal distribution
- 3.1.2 use the table of values of the standard normal curve to find probabilities.
- 3.1.3 explain how the shape of the normal curve changes as μ and σ are varied.
- 3.1.4 approximate binomial (and Poisson distributions) by a normal distribution and know the conditions under which these approximations can be made.

4. *To estimate an average in a given population using confidence intervals, small samples and taking confidence levels into account.*

4.1 SAMPLING AND ESTIMATION

- 4.1.1 explain the terms: parameter, statistic, population, sample, random sample.
- 4.1.2 explain what is meant by the sampling distribution of the mean.
- 4.1.3 demonstrate an understanding of the difference between the random variables x and s^2 and the parameters μ and σ^2 .
- 4.1.4 state and use the properties of the sampling distribution of the mean for normal populations.
- 4.1.5 demonstrate an understanding of the Central Limit Theorem.
- 4.1.6 find confidence intervals to estimate a mean, both when σ is known (optional) and when σ is unknown (Student's t-distribution).

5. *To perform the most appropriate test of hypothesis.*

5.1 HYPOTHESIS TESTS

- 5.1.1 give the main steps in the test of a hypothesis:
 - 5.1.1.1 formulation of null and alternate hypothesis;
 - 5.1.1.2 calculation of appropriate statistic;
 - 5.1.1.3 formulation of a criterion for decision;
 - 5.1.1.4 application of criterion and conclusion.
- 5.1.2 explain Type I and Type II errors.
- 5.1.3 carry out hypothesis tests of the following types:
 - 5.1.3.1 test for one population mean when σ is known and when it is unknown;
 - 5.1.3.2 test for the difference between two means (large samples and small samples) with equal standard deviations and with unequal standard deviations.
 - 5.1.3.3 test for the difference between two means using paired samples;
 - 5.1.3.4 test for one proportion and for two proportions.
- 5.1.4 use the chi-square statistic to carry out hypothesis tests for goodness of fit and for independence.