

Higher Mathematics Course — Statistics and Probability

Adopted 2010

Higher Mathematics Course — Statistics and Probability

Interpreting Categorical and Quantitative Data

- A. Summarize, represent, and interpret data on a single count or measurement variable **HSS.ID.A**
 - 1. Represent data with plots on the real number line (dot plots, histograms, and box plots). **S.ID.1**
 - 2. Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. **S.ID.2**
 - 3. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). **S.ID.3**
 - 4. Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. **S.ID.4**
- B. Summarize, represent, and interpret data on two categorical and quantitative variables **HSS.ID.B**
 - 5. Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data. **S.ID.5**
 - 6. Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. **S.ID.6**
 - a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. **S.ID.6.A**
 - b. Informally assess the fit of a function by plotting and analyzing residuals. **S.ID.6.B**
 - c. Fit a linear function for a scatter plot that suggests a linear association. **S.ID.6.C**

C. Interpret linear models **HSS.ID.C**

7. Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. **S.ID.7**
8. Compute (using technology) and interpret the correlation coefficient of a linear fit. **S.ID.8**
9. Distinguish between correlation and causation. **S.ID.9**

Making Inferences and Justifying Conclusions

A. Understand and evaluate random processes underlying statistical experiments **HSS.IC.A**

1. Understand statistics as a process for making inferences about population parameters based on a random sample from that population. **S.IC.1**
2. Decide if a specified model is consistent with results from a given data-generating process, e.g., using simulation. **S.IC.2**

B. Make inferences and justify conclusions from sample surveys, experiments, and observational studies **HSS.IC.B**

3. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. **S.IC.3**
4. Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling. **S.IC.4**
5. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. **S.IC.5**
6. Evaluate reports based on data. **S.IC.6**

Conditional Probability and the Rules of Probability

- A. Understand independence and conditional probability and use them to interpret data **HSS.CP.A**
1. Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). **S.CP.1**
 2. Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent. **S.CP.2**
 3. Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A, and the conditional probability of B given A is the same as the probability of B. **S.CP.3**
 4. Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. **S.CP.4**
 5. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. **S.CP.5**
- B. Use the rules of probability to compute probabilities of compound events in a uniform probability model **HSS.CP.B**
6. Find the conditional probability of A given B as the fraction of B's outcomes that also belong to A, and interpret the answer in terms of the model. **S.CP.6**
 7. Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model. **S.CP.7**
 8. (+) Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$, and interpret the answer in terms of the model. **S.CP.8**
 9. (+) Use permutations and combinations to compute probabilities of compound events and solve problems. **S.CP.9**

Using Probability to Make Decisions

- A. Calculate expected values and use them to solve problems **HSS.MD.A**
1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions. **S.MD.1**
 2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. **S.MD.2**
 3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value. **S.MD.3**
 4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value. **S.MD.4**

B. Use probability to evaluate outcomes of decisions **HSS.MD.B**

- 5.** (+) Weigh the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values. **S.MD.5**
 - a.** Find the expected payoff for a game of chance. **S.MD.5.A**
 - b.** Evaluate and compare strategies on the basis of expected values. **S.MD.5.B**
- 6.** (+) Use probabilities to make fair decisions (e.g., drawing by lots, using a random number generator). **S.MD.6**
- 7.** (+) Analyze decisions and strategies using probability concepts (e.g., product testing, medical testing, pulling a hockey goalie at the end of a game). **S.MD.7**