West Virginia Mathematics

Statistics

Adopted 2024

Statistics

Descriptive Statistics

1. Summarize, represent, and interpret data on single count or measurement variable. S.DS.1
    1. Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. M.PS.1
    2. 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. M.PS.2
    3. Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant. M.PS.3
    4. Evaluate reports based on data. Write a function that describes a relationship between two quantities. M.PS.4
    5. Represent data with plots on the real number line (dots plots, histograms, and box plots). M.PS.5
    6. Use statistics appropriate to the shape of the data distributions to compare center and spread of two or more different data sets. Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). M.PS.6
    7. 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. M.PS.7
    8. 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. M.PS.8

Probability

2. Understand independence and conditional probability and use them to interpret data. S.DS.2

    9. 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"). M.PS.9

    10. 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. M.PS.10

    11. Recognize the conditional probability of A given B as P(A 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. M.PS.11

    12. 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. For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results. M.PS.12

    13. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer. M.PS.13

    14. 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. M.PS.14

    15. Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B) and interpret the answer in terms of the model. M.PS.15

    16. Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B) and interpret the answer in terms of the model. M.PS.16

    17. Use permutations and combinations to compute probabilities of compound events and solve problems. M.PS.17

Probability Distributions

3. Calculate expected values and use them to solve problems. S.DS.3

    18. 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. M.PS.18

    19. Calculate the expected value of a random variable; interpret it as the mean of the probability distribution. M.PS.19

    20. Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated to find the expected value. M.PS.20

    21. Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically to find the expected value. M.PS.21

    22. Weight the possible outcomes of a decision by assigning probabilities to payoff values and finding expected values (e.g., find the expected payoff for a game of chance). M.PS.22

    23. Evaluate and compare strategies on the basis of expected values. M.PS.23

    24. Analyze decisions and strategies using probability concepts. M.PS.24

Correlation and Regression

4. Interpret linear models. S.DS.4

    25. Represent data on two quantitative variables on a scatter plot and describe how the variables are related. M.PS.25

        a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear and exponential models. M.PS.25.A

        b. Informally assess the fit of a function by plotting and analyzing residuals. Focus should be on situations for which linear models are appropriate. M.PS.25.B

        c. Fit a linear function for scatter plots that suggest a linear association. M.PS.25.C

    26. Interpret the rate of change and the constant term of a linear model in the context of the data. Use technology to compute and interpret the correlation coefficient of a linear fit. M.PS.26

    27. Distinguish between correlation and causation. M.PS.27

Confidence Intervals

5. Determine and interpret confidence intervals. S.DS.5
    28. Find the point estimate and margin of error in a given scenario. M.PS.28
    29. Construct and interpret confidence intervals for the population mean. M.PS.29
    30. Determine minimum sample size requirements when estimating mean, μ (population proportion). M.PS.30
    31. Interpret the t-distribution and use t-distribution table in real-world scenarios. M.PS.31
    32. Construct confidence intervals when the sample size, n, is less than 30, population is normally distributed, and standard deviation, σ, is unknown. M.PS.32
    33. Interpret the chi-square distribution and use chi-square distribution table. Use the chi-square distribution to construct a confidence interval for the variance and standard deviation. M.PS.33

Hypothesis Testing with One Variable

6. Use hypothesis testing in making and interpreting decisions. S.DS.6
    34. Interpret a hypothesis test; state a null hypothesis and an alternative hypothesis. M.PS.34
    35. Identify Type I and Type II errors and interpret the level of significance. M.PS.35
    36. Use one-tailed and two-tailed statistical tests to find p-value. M.PS.36
    37. Make and interpret decisions on comparing two hypotheses based on results of a statistical test. Write a claim for a hypothesis test. M.PS.37
    38. Find probability values and test for mean. Use in a z-test. M.PS.38
    39. Find critical values and rejection regions in a normal distribution. Use rejection regions for a z-test. M.PS.39
    40. Find critical values in a t-distribution and use the t-test to test a mean. M.PS.40
    41. Use the z-test to test a population proportion, p. M.PS.41
    42. Find critical values for chi squared test. Use the chi squared test to test a variance or a standard deviation. M.PS.42

Statistical Inference

7. Determine and use correlation. S.DS.7
    43. Find a correlation coefficient. M.PS.43
    44. Test a population correlation coefficient using a table. M.PS.44
    45. Perform a hypothesis test for a population correlation coefficient. M.PS.45
    46. Distinguish between correlation and causation. M.PS.46
8. Use linear regression to predict and interpret. S.DS.8
    47. Find the equation of a regression line; predict y-values using a regression line. M.PS.47
    48. Interpret the types of variation about a regression line. M.PS.48
    49. Find and interpret the coefficient of determination. M.PS.49
    50. Find and interpret the standard error of estimate for a regression line; construct and interpret a prediction interval for y. M.PS.50
    51. Use technology to find a multiple regression equation, the standard error of estimate, and the coefficient of determination. M.PS.51
9. Use statistical tests to determine a relationship. S.DS.9
    52. Use a contingency table to find expected frequencies. M.PS.52
    53. Use the chi-squared distribution to test whether a frequency distribution fits a claimed distribution and to test whether two variables are independent. M.PS.53
    54. Interpret the F-distribution and use an F-table to find critical values. M.PS.54
    55. Perform a two-sample F-test to compare two variances. M.PS.55
    56. Perform a two-sample F-test to compare two variances. Interpret the F-distribution and use an F-table to find critical values. M.PS.56
    57. Use one-way analysis of variance to test claims involving three or more means. Introduce two-way analysis of variance. M.PS.57