

List of Formulas, Procedures and Boxes for Quiz 3, April 11

(Quiz 3 will be on Friday, April 11, and covers material from Chapter 18.4.)

Math 125 *Kovitz* Spring 2025

From Text

Box on page 289.

Both boxes on page 291.

Page 291: top two paragraphs of text.

Box on page 298.

Box on page 301.

Section 18.4: up to the solution of Example 1(c) on top part of page 318.

Boxes on pages 325 and 326.

Formulas

Conversion to Standard Units

An observed sum is converted to standard units by seeing how many SEs it is above or below the expected value.

The formula is: $\text{standard units} = \frac{\text{observed sum} - \text{expected value for the sum}}{\text{SE for sum}}.$

The Normal Approximation for Data

If a histogram follows the normal curve, approximate areas may be found by converting the endpoints to standard units and finding the appropriate areas under the normal curve by using the Table.

The Expected Value for the Sum of the Draws

The expected value for the sum of draws made at random with replacement from a box equals
 $(\text{number of draws}) \times (\text{average of box}).$

The Standard Error for the Sum of the Draws

A sum is likely to be around its expected value, but to be off by a chance error similar in size to the standard error.

When drawing at random with replacement from a box of numbered tickets, the standard error for the sum of the draws is

$$\sqrt{\text{number of draws}} \times (\text{SD of box}).$$

Using the Normal Curve to Find the Chance that the Sum of a Large Number of Draws (made at random with replacement from a box) will be in a Given Range.

First find the expected value and standard error for the sum of draws.

Next convert the endpoints of the given range to standard units using the formula

$$\text{standard units} = \frac{\text{given value} - \text{expected value}}{\text{standard error}}.$$

The area under the normal curve between the standard units for the endpoints of the given range will be an approximation for the desired chance.

A Shortcut for the SD of a Box with Only Two Kinds of Tickets

When the tickets in the box show only two different numbers, the SD of the box equals

$$\left(\frac{\text{bigger}}{\text{number}} - \frac{\text{smaller}}{\text{number}} \right) \times \sqrt{\frac{\text{fraction with}}{\text{bigger number}} \times \frac{\text{fraction with}}{\text{smaller number}}}$$

Classifying and Counting

If you have to classify and count the draws, put 0's and 1's on the tickets. Mark 1 on the tickets that count for you, 0 on the others.

Then find the average of the box and the expected value, and the SD (using the shortcut) and the standard error. Now convert any given values of the count to standard units and use the normal curve to approximate any chance being sought.

The main ideas, procedures, and formulas appear below.

The Normal Approximation to Binomial Probabilities

If a binomial probability is considered as the sum of repeated draws from a suitable counting box, the normal approximation may be used—provided the number of trials (draws from the box) is suitably large.

The expected value is the product of the number of trials and the average of the counting box. The standard error is the product of the square root of the number of trials and the SD of the counting box (found by the short cut).

Since the sum of the draws is discrete, it is more accurate to correct the endpoints of the intervals by plus or minus one half.

Next convert the endpoints of the given range to standard units using the formula

$$\text{standard units} = \frac{\text{given value (corrected)} - \text{expected value}}{\text{standard error}}.$$

The area under the normal curve between the standard units for the corrected endpoints of the given range will be an approximation for the desired chance.