

Excel & Business Math
Video/Class Project #24

COUNTIFS Function & Part / Base to Calculate Probabilities (Frequency Distribution)

Topics

| | |
|---|---|
| 1) What is Probability? What is a Frequency Distribution? | 1 |
| 2) COUNTIFS Function to Count with a Specific Condition | 2 |
| 3) Example 1: Create a Frequency Distribution to Calculate Probabilities of Getting a Certain Grade in Math Class | 3 |
| 4) Example 2: Create a Frequency Distribution to Calculate Probabilities of Getting a Certain Grade in English..... | 4 |
| 5) Example 3: Create a Frequency Distribution to Calculate Probabilities for # of Banquet Room Use..... | 5 |
| 6) Example 4: Create a Frequency Distribution to Calculate Probabilities for What Type of Item Will Be Purchased..... | 6 |

What is Probability?

Probability:

All Synonyms: Probability = Chance = Likelihood = Probable = Probably

Chance that something will occur in the unknown future

Numerical measure of the likelihood that an event will occur in the future

Probability is an estimate of an event that may occur in the future

Probability is never known with certainty

Probability is only an estimate

Probability is a number between 0 and 1

Examples:

Probability that the sun will go out in the next 5 second = **0**

Probability that it will rain in Seattle next year = **1**

Probability that you will get a six when you roll a die = **1/6**

Probability that you will get a B Grade in your English class = **6.4%**

Probability that it the next customer will buy food at Target is **0.15**

Frequency Distributions:

Frequency Distributions count how many times an event occurs

and then compared each count (a Part) to the Total

to get a Decimal or Percent that can be used to estimate the future.

Below is a Frequency Distribution, which counts the number of times students in the past got a particular grade and then using the Part/Base Formula calculates the probability of getting a particular grade.

| Grade | Count (Frequency) | Part / Base Probability Relative Frequency |
|--------------|-------------------|--|
| A + | 5 | 0.4% |
| A | 48 | 4.0% |
| A - | 54 | 4.5% |
| B + | 91 | 7.6% |
| B | 77 | 6.4% |
| B - | 183 | 15.3% |
| C + | 97 | 8.1% |
| C | 167 | 13.9% |
| C - | 131 | 10.9% |
| D + | 149 | 12.4% |
| D | 105 | 8.8% |
| D - | 73 | 6.1% |
| F | 20 | 1.7% |
| Total | 1200 | 100.0% |

Let's look at some examples of how we can estimate probabilities based on past data ==>>

| | A | B | C | D | E | F | G | H |
|----|---|----------|-------|---|---|---|------------------------|-------|
| 1 | COUNTIFS function: | | | | | | | |
| 2 | Can count with 1 or more conditions/criteria. | | | | | | | |
| 3 | Counts just some of the items in a range of cells based on a condition of set of criteria. | | | | | | | |
| 4 | COUNTIFS(criteria_range1, criteria1) | | | | | | | |
| 5 | criteria_range1 argument will contain the range with all the items to possible count. | | | | | | | |
| 6 | criteria1 argument contains the condition or criteria that tells the function what to count. | | | | | | | |
| 7 | Conditions and criteria could be things like: | | | | | | | |
| 8 | Text (like "Gigi"). | | | | | | | |
| 9 | Dates or Numbers like: 10/23/2017 | | | | | | | |
| 10 | | | | | | | | |
| 11 | | | | | | | | |
| 12 | **When you specify a "criteria" or "condition" you are saying: "don't count all the items, just on some of the items". | | | | | | | |
| 13 | | | | | | | | |
| 14 | | | | | | | | |
| 15 | Date | SalesRep | Sales | | | | COUNTIFS | |
| 16 | 10/23/2017 | Chin | \$100 | | | | Count with 1 condition | |
| 17 | 10/23/2017 | Gigi | \$200 | | | | Criteria | Count |
| 18 | 10/24/2017 | Dawn | \$100 | | | | Gigi | 4 |
| 19 | 10/24/2017 | Chin | \$300 | | | | Criteria | Count |
| 20 | 10/24/2017 | Chin | \$700 | | | | 10/23/2017 | 4 |
| 21 | 10/23/2017 | Dawn | \$100 | | | | | |
| 22 | 10/24/2017 | Gigi | \$200 | | | | | |
| 23 | 10/24/2017 | Gigi | \$500 | | | | | |
| 24 | 10/23/2017 | Gigi | \$200 | | | | | |

=COUNTIFS(B16:B24,E18)

=COUNTIFS(A16:A24,E20)

| | | | | | | | | | | |
|----|--|--------------|---|---|---|---|---|---|---|---|
| | A | B | C | D | E | F | G | H | I | J |
| 1 | Example 1: Use COUNTIFS Function to Create a Frequency Distribution | | | | | | | | | |
| 2 | to Calculate Probabilities of Getting a Certain Grade in Math Class (based on past grade data) | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | Class: | Math 148 | | | | | | | | |
| 5 | | | Past 5 Year Data: Probability of a Given Grade for Math 148 | | | | | | | |
| 6 | Data Set For Math 148 Class Over Last 5 Years | | Past 5 Year Data: Changes of a Given Grade for Math 148 | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| | | | | | | | | | | |
| 10 | Student ID | Year Quarter | Grade | | | | | | | |
| 11 | 85-339-5087 | 2016 - Q4 | D - | | | | | | | |
| 12 | 95-874-9761 | 2015 - Q3 | A | | | | | | | |
| 13 | 84-888-0967 | 2014 - Q4 | A | | | | | | | |
| 14 | 81-192-8643 | 2016 - Q4 | B | | | | | | | |
| 15 | 78-964-6506 | 2014 - Q1 | B - | | | | | | | |
| 16 | 79-156-3076 | 2015 - Q3 | B + | | | | | | | |
| 17 | 85-346-3439 | 2012 - Q3 | C + | | | | | | | |
| 18 | 86-968-5197 | 2016 - Q2 | B + | | | | | | | |
| 19 | 93-274-9991 | 2013 - Q1 | C | | | | | | | |
| 20 | 78-029-6106 | 2012 - Q3 | C | | | | | | | |
| 21 | 95-157-6118 | 2017 - Q2 | C + | | | | | | | |
| 22 | 92-496-8649 | 2017 - Q3 | A | | | | | | | |
| 23 | 74-539-4166 | 2017 - Q1 | B - | | | | | | | |
| 24 | 88-965-5292 | 2012 - Q2 | B | | | | | | | |
| 25 | 79-088-1144 | 2017 - Q3 | A | | | | | | | |
| 26 | 91-380-5996 | 2016 - Q4 | F | | | | | | | |
| 27 | 93-276-2527 | 2013 - Q1 | B - | | | | | | | |

| | | |
|-------|----------------------|--|
| Grade | Count (Frequency) | Part / Base Probability Relative Frequency |
| A + | 5 | 0.4% |
| A | 48 | 4.0% |
| A - | 54 | 4.5% |
| B + | 91 | 7.6% |
| B | 77 | 6.4% |
| B - | 183 | 15.3% |
| C + | 97 | 8.1% |
| C | 167 | 13.9% |
| C - | 131 | 10.9% |
| D + | 149 | 12.4% |
| D | 105 | 8.8% |
| D - | 73 | 6.1% |
| F | 20 | 1.7% |
| Total | 1200 | 100.0% |

Formulas:

In cell F11: =COUNTIFS(\$C\$11:\$C\$1210,E11)

In cell G11: =F11/\$F\$24

| |
|---|
| Past 5 Year Data: Probability of a Given Grade for Math 148 |
| Past 5 Year Data: Changes of a Given Grade for Math 148 |

Frequency Distribution to Calculate Probabilities:

| Grade | Count (Frequency) | Part / Base Probability Relative Frequency |
|--------------|----------------------|--|
| A + | 5 | 0.4% |
| A | 48 | 4.0% |
| A - | 54 | 4.5% |
| B + | 91 | 7.6% |
| B | 77 | 6.4% |
| B - | 183 | 15.3% |
| C + | 97 | 8.1% |
| C | 167 | 13.9% |
| C - | 131 | 10.9% |
| D + | 149 | 12.4% |
| D | 105 | 8.8% |
| D - | 73 | 6.1% |
| F | 20 | 1.7% |
| Total | 1200 | 100.0% |

Formulas:
In cell F11: =COUNTIFS(\$C\$11:\$C\$1210,E11) In cell G11: =F11/\$F\$24

| | A | B | C | D | E | F | G | H | I | J |
|----|---|---------------------|--------------|---|--|---|---|---|---|---|
| 1 | Example 2: Use COUNTIFS Function to Create a Frequency Distribution | | | | | | | | | |
| 2 | to Calculate Probabilities of Getting a Certain Grade in English (based on past grade data) | | | | | | | | | |
| 3 | | | | | | | | | | |
| 4 | Class: | Eng 101 | | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | Data Set For Eng 101 Class Over Last 5 Years | | | | Past 5 Year Data: Probability of a Given Grade for Eng 101 | | | | | |
| 7 | | | | | Past 5 Year Data: Changes of a Given Grade for Eng 101 | | | | | |
| 8 | | | | | | | | | | |
| 9 | | | | | | | | | | |
| 10 | Student ID | Year Quarter | Grade | | | | | | | |
| 11 | 94-066-4208 | 2016 - Q2 | B + | | | | | | | |
| 12 | 83-281-9743 | 2017 - Q1 | B | | | | | | | |
| 13 | 76-710-9562 | 2016 - Q1 | A | | | | | | | |
| 14 | 95-061-2149 | 2013 - Q2 | F | | | | | | | |
| 15 | 75-041-9778 | 2012 - Q1 | B - | | | | | | | |
| 16 | 75-960-8489 | 2012 - Q1 | C + | | | | | | | |
| 17 | 79-833-8061 | 2016 - Q4 | A - | | | | | | | |
| 18 | 95-015-1736 | 2015 - Q1 | D - | | | | | | | |
| 19 | 71-582-6691 | 2013 - Q2 | B + | | | | | | | |
| 20 | 92-353-8718 | 2013 - Q4 | A | | | | | | | |
| 21 | 75-505-3099 | 2014 - Q3 | C + | | | | | | | |
| 22 | 76-954-2004 | 2012 - Q3 | C | | | | | | | |
| 23 | 83-440-4595 | 2014 - Q2 | B + | | | | | | | |
| 24 | 84-061-9572 | 2013 - Q3 | A | | | | | | | |
| 25 | 91-787-8127 | 2014 - Q2 | C | | | | | | | |
| 26 | 84-232-8979 | 2014 - Q3 | B + | | | | | | | |
| 27 | 72-719-3129 | 2015 - Q4 | C - | | | | | | | |

| Frequency Distribution to Calculate Probabilities: | | |
|--|----------------------|--|
| Grade | Count (Frequency) | Part / Base Probability Relative Frequency |
| A + | 34 | 2.7% |
| A | 143 | 11.5% |
| A - | 176 | 14.1% |
| B + | 135 | 10.8% |
| B | 82 | 6.6% |
| B - | 158 | 12.7% |
| C + | 160 | 12.8% |
| C | 97 | 7.8% |
| C - | 114 | 9.1% |
| D + | 33 | 2.6% |
| D | 26 | 2.1% |
| D - | 43 | 3.4% |
| F | 47 | 3.8% |
| Total | 1248 | 100.0% |

Formulas:
 In cell F11: =COUNTIFS(\$C\$11:\$C\$1258,E11)

Formulas:
 In cell G11: =F11/\$F\$24

| | A | B | C | D | E | F | G | H | I |
|----|--|----------------------|---|---|---|---|---|---|---|
| 1 | Example 3: Use COUNTIFS Function to Create a Frequency Distribution | | | | | | | | |
| 2 | to Calculate Probabilities for # of Banquet Room Use (based on past restaurant data) | | | | | | | | |
| 3 | | | | | | | | | |
| 4 | Isaac's Italian Restaurant has 4 banquet rooms | | | Probability or Chances that a Given # of Rooms will be used | | | | | |
| 5 | Over the past year, they collected the below data: | | | | | | | | |
| 6 | | | | | | | | | |
| 7 | | | | | | | | | |
| 8 | Day | # Rooms Used for Day | | | | | | | |
| 9 | Fri, Jan 3, 2014 | 1 | | | | | | | |
| 10 | Sat, Jan 4, 2014 | 2 | | | | | | | |
| 11 | Fri, Jan 10, 2014 | 4 | | | | | | | |
| 12 | Sat, Jan 11, 2014 | 3 | | | | | | | |
| 13 | Fri, Jan 17, 2014 | 3 | | | | | | | |
| 14 | Sat, Jan 18, 2014 | 2 | | | | | | | |
| 15 | Fri, Jan 24, 2014 | 2 | | | | | | | |
| 16 | Sat, Jan 25, 2014 | 2 | | | | | | | |
| 17 | Fri, Jan 31, 2014 | 4 | | | | | | | |
| 18 | Sat, Feb 1, 2014 | 1 | | | | | | | |
| 19 | Fri, Feb 7, 2014 | 2 | | | | | | | |
| 20 | Sat, Feb 8, 2014 | 2 | | | | | | | |
| 21 | Fri, Feb 14, 2014 | 2 | | | | | | | |
| 22 | Sat, Feb 15, 2014 | 1 | | | | | | | |

| # Rooms Used | Count (Frequency) | Part / Base Probability Relative Frequency |
|--------------|-------------------|---|
| 0 | 2 | 0.02 |
| 1 | 21 | 0.21 |
| 2 | 42 | 0.42 |
| 3 | 27 | 0.27 |
| 4 | 8 | 0.08 |
| Total | 100 | 1 |

Formulas:
In cell E9: =COUNTIFS(\$B\$9:\$B\$108,D9)

Formulas:
In cell F9: =E9/\$E\$14

Probability or Chances that a Given # of Rooms will be used

Frequency Distribution to Calculate Probabilities:

| # Rooms Used | Count (Frequency) | Part / Base Probability Relative Frequency |
|--------------|-------------------|---|
| 0 | 2 | 0.02 |
| 1 | 21 | 0.21 |
| 2 | 42 | 0.42 |
| 3 | 27 | 0.27 |
| 4 | 8 | 0.08 |
| Total | 100 | 1 |

Formulas:

In cell E9: =COUNTIFS(\$B\$9:\$B\$108,D9)

Formulas:

In cell F9: =E9/\$E\$14

| | A | B | C | D | E | F | G | H | I | J | |
|----|---|--------|----------------|---|---|---|---|---|---|---|--|
| 1 | Example 4: Use COUNTIFS Function to Create a Frequency Distribution | | | | | | | | | | |
| 2 | to Calculate Probabilities for What Type of Item Will Be Purchased (based on past sales data) | | | | | | | | | | |
| 3 | | | | | | | | | | | |
| 4 | Data from Last 9,979 Customers at Target: | | | Probability or Chances that a Given Item Purchased will be: | | | | | | | |
| 5 | | | | | | | | | | | |
| 6 | | | | | | | | | | | |
| 7 | Frequency Distribution to Calculate Probabilities: | | | | | | | | | | |
| 8 | Transaction Number | Amount | Item Purchased | | | | | | | | |
| 9 | 70000 | 32.4 | Other | | | | | | | Formulas: | |
| 10 | 70000 | 12.4 | Food | | | | | | | In cell F9: =COUNTIFS(\$C\$9:\$C\$60005,E9) | |
| 11 | 70000 | 29.15 | Other | | | | | | | Formulas: | |
| 12 | 70000 | 15.82 | Toys | | | | | | | In cell G9: =F9/\$F\$15 | |
| 13 | 70000 | 39.22 | Home | | | | | | | | |
| 14 | 70000 | 66.13 | Home | | | | | | | | |
| 15 | 70001 | 20.63 | Food | | | | | | | | |
| 16 | 70001 | 40.6 | Home | | | | | | | | |
| 17 | 70001 | 1.07 | Food | | | | | | | | |
| 18 | 70001 | 17.74 | Home | | | | | | | | |
| 19 | 70001 | 41.93 | Home | | | | | | | | |
| 20 | 70002 | 35.12 | Home | | | | | | | | |
| 21 | 70003 | 23.58 | Home | | | | | | | | |

| Item Purchased | Count (Frequency) | Part / Base Probability Relative Frequency |
|----------------|-------------------|--|
| Home | 18,779 | 31.3% |
| Other | 13,091 | 21.8% |
| Electronics | 12,072 | 20.1% |
| Food | 9,055 | 15.1% |
| Garden | 4,370 | 7.3% |
| Toys | 2,630 | 4.4% |
| Total | 59,997 | 100.0% |