Data 8R
Summer 2017

Tables and more Visualizations

Discussion 5: July 11, 2017

1 Review

Write down the definitions of the following terms in your own words:

RCT (Randomized Control Trial)

Observational Study

Confounding factor

Observational Study or RCT:

A researcher at a hospital decides to study a group of students from Berkeley. He/she decides to record data for each subject on the amount of exercise they do for an entire year. At the same time, the researcher also records the number of colds each volunteer gets.

Is this an observational study or an RCT?

If the researcher finds that people who exercise more get fewer colds, what can we say from this?

Is it a valid conclusion to claim that there is an association between exercise and fewer colds in elderly people?

Observational study.

There is an assocation between getting colds and exercising - we cannot conclude causation because there is only a randomized experiment can confirm that.

No. There is no external validity because the demographic of students we studied is not the same as the elderly, hence we cannot claim an association among this group. Note: Age is not a confounding factor here.

Write all the subexpressions for the following expressions:

```
>>> 5 + (15 * (6 / 2))
```

5 (15 * (6 / 2)) 15 (6 / 2) 6 2

```
>>> make_array(10, 15, 20).item(0)
```

make$_{a}rray(10, 15, 20)101520make_{a}rray0make_{a}rray(10, 15, 20).item$

Write down the outputs of the following code:

Assume that the following lines of code have already been executed:

```
>>> array1 = np.arange(1, 11)
>>> array2 = make_array(3, 5, 9, 10)
```

Write down the outputs of following line:

```
>>> np.diff(array2)
```

```
[2, 4, 1]
```

```
>>> array1 / sum(array1)
```

```
[1/55, 2/55, 3/55, 4/55, 5/55, 6/55, 7/55, 8/55, 9/55, 10/55]
```

2 Bar Charts

A **frequency/probability** distribution is a distribution whose amounts have been normalized to add up to 1. In other words, a frequency distribution describes the proportions of some data. On the other hand, when a distribution does not describe the proportions, it is called a **count** distribution. In other words, this means that a **count** distribution contains data about a *count* of some things.

Answer the following questions:

What is the difference between categorical and numerical variables?

Which variable should you use a bar chart to visualize and why?

Can bar charts be used to graph proportions?

Categorical variables are strings, numbers, etc. that represent categories, and thus cannot have mathematical operators applied to them.

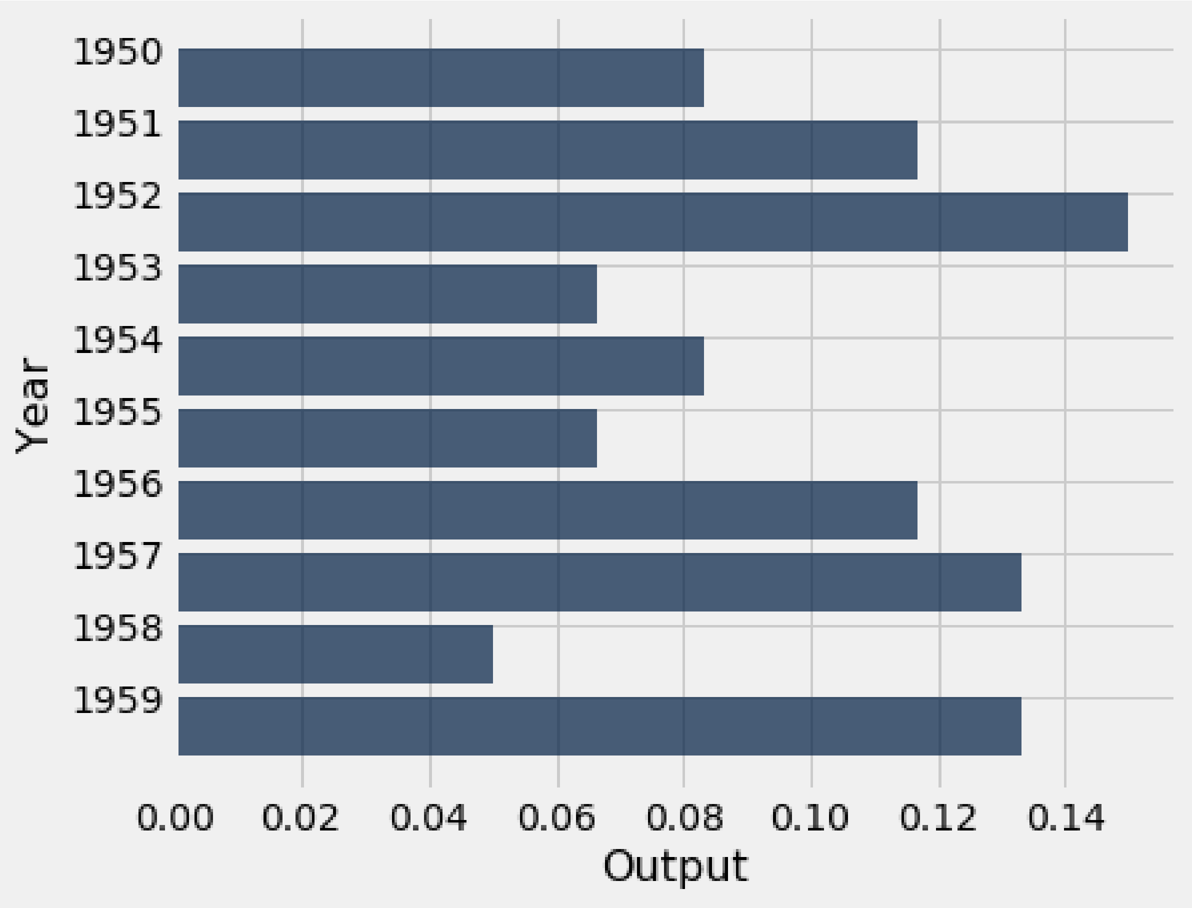
Numerical variables are variables that represent metrics or quantities. They can have mathematical operators applied to them.

We should use bar charts to graph categorical variables.

Yes.

Examine the following bar chart and answer some questions about it.

A business has graphed the proportion of outputs in each year as a bar chart.



If the business wanted to compare outputs from year to year, does this bar chart serve its purpose?

If the business wanted to compare outputs for each 2-year period, does the bar chart serve its purpose?

Yes, it allows us to compare each year against each other.

No, not easy to visualize combining the bars together.

3 Histograms

Should you use a histogram to graph categorical or numerical variables and why?

What does the width of a histogram bar represent?

What does the height of a histogram bar represent?

What does the area of a histogram bar represent?

What should the entire area of a histogram sum to (if we're using a frequency distribution)?

Numerical variables, because it allows us to see the distribution of the proportions.

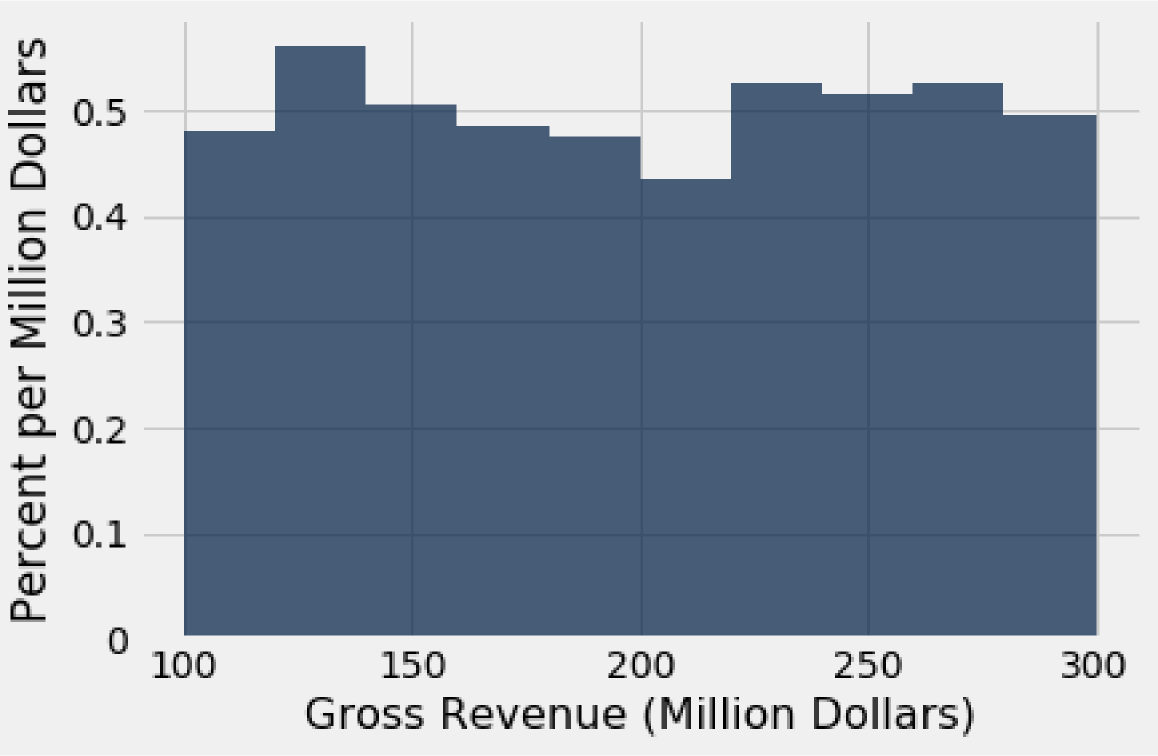
The width represents size of the group of data. It represents the number of units.

The height represents the density in that bin (in the units that the width represents). Ie. It represents the percent of entries per unit in the bin relative the width of that bin.

The area represents the proportion of elements in the bin (ie. number of elements * percent of entries per unit in the bin).

The entire area of a histogram should sum to 1 if we're using a frequency distribution. It should sum to the count if we use a count distribution.

Suppose the same business has now made a histogram of their gross revenues:



What was the most common revenue range?

What does the height of each bar of this histogram represent?

What does the area of each bar in this histogram represent?

120-140 millin dollars

The height represents the percent per million dollars of the values of each bin.

The area represents the percentage of gross revenues that fell within each bin (ie. the proportions)