

# Lecture 9: Normal Approximation

## Chapter 3.2

# Goals for Today

- ▶ Discuss how to find %'iles for negative values of  $z$
- ▶ Examples
- ▶ Evaluating how “normal” certain data are.

# Solving Normal Questions

Whenever solving questions of this sort **ALWAYS** draw a rough picture first and keep in mind:

1. The normal distribution/curve is **symmetric**
2. The total area under the curve is 1

# Normal Probability Tables

Alternatively, whereas

- ▶ table on P.409 gives areas to the left of positive values of  $z$ .
- ▶ table on P.408 gives areas to the left of negative values of  $z$ .

I'm only going to give you P.409 table for exams.

## Speeding on I-5

The distribution of passenger vehicle speeds traveling on Interstate 5 Freeway (I-5) in California is nearly normal with a mean of 72.6 mph and a standard deviation of 4.78 mph.

- a) What percent of passenger vehicles travel slower than 80 mph?
- b) What percent of passenger vehicles travel between 60 and 80 mph?
- c) How fast to do the fastest 5% of passenger vehicles travel?
- d) The speed limit on this stretch of the I-5 is 70 mph.  
Approximate what percentage of the passenger vehicles travel above the speed limit on this stretch of the I-5.

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## Switching Gears: Normal Approximation

Although we stated that many processes in the physical world look bell-shaped, i.e. roughly normal, we must keep in mind that this is an **approximation**.

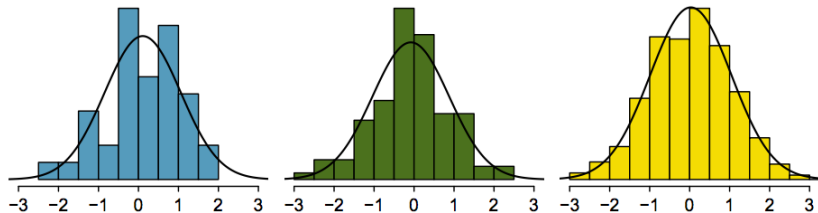
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**Question:** How do we verify normality?

# Normal Approximation

What about these ones? How well do the histograms fit to the normal curve?



# Normal Probability Plots

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The  $k^{\text{th}}$   $q$  – *quantile* is the value such that proportion  $\frac{k}{q}$  of the observations fall below it. So

- ▶ The 4-quantiles are the *quartiles*.
- ▶ The 100-quantiles are the *percentiles*.



# Normal Probability Plots

A normal probability plot compares:

- ▶ The **observed** quantiles of a data set (on the  $y$ -axis)
- ▶ The **theoretical** quantiles that are **exactly** normal (on the  $x$ -axis)

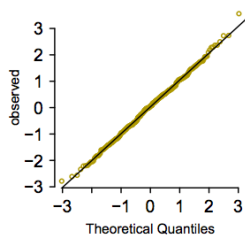
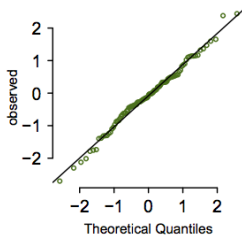
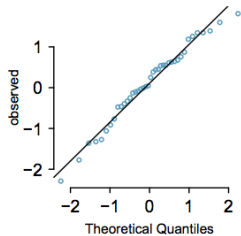
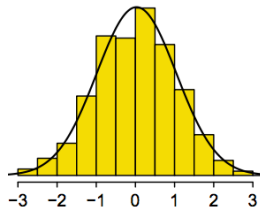
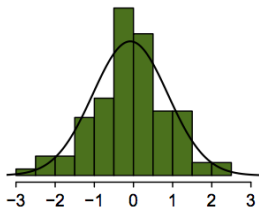
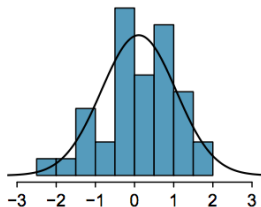
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The more “normal” the data is, the better the fit.

# Normal Probability Plots



## Next Time

- ▶ Introduce some of the more useful other distributions:  
Bernoulli, Geometric, Binomial, and Poisson