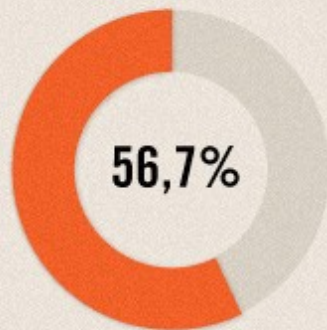
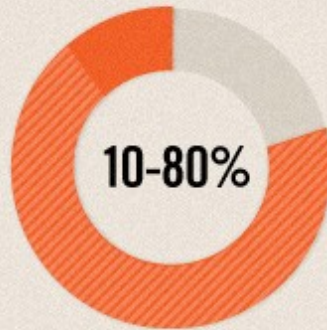


What is statistics?

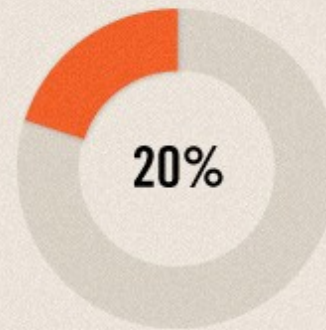
# Statistics about statistics



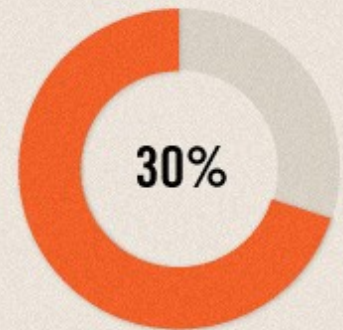
**of all statistics  
have added an extra decimal,  
to seem more trustworthy.**



**of all statistics are  
more or less imprecise.**



**or about 1/4 of  
all statistics contain  
miscalculations**



**of all statistics  
are inconsistent**

## STATISTICS ABOUT STATISTICS

**2** out  
of **5%**

... of all statistics are  
relatively confusing

**200.00**

... of all statistics are  
ruined every day due  
to poor punctuation

**33,3333%**

... of all statistics are not  
as precise as they seem

**84%**

... of all statistics are  
completely made up  
to emphasize a point













- <https://www.youtube.com/watch?v=8vNJ5Krj7SQ>











# Recap

- Statistics helps us understand uncertainty.
- Statisticians are everyday detectives.
- Randomness doesn't always look random.
- Even in short runs there can be big clusters.
- Chance doesn't mean without cause.
- Tree or a tiger?

# Problem Session 1

- <http://understandinguncertainty.org/coincidences>
- <http://www.dailymail.co.uk/sciencetech/article-1240746/Prehistoric-sat-nav-set-ancestors-Britain.html>



# Games and Gambling



# Gambler's Ruin



# The Simple Game

- Player starts with £10
- Player tosses a coin
- Heads wins £1
- Tails loses £1
- Play until you win £20 (WIN)
- Or run out of money (LOSE)

# Monte Carlo Simulation





# Why simulate?





# Populations and Samples





# Blackjack and Bankrolls



# Real World





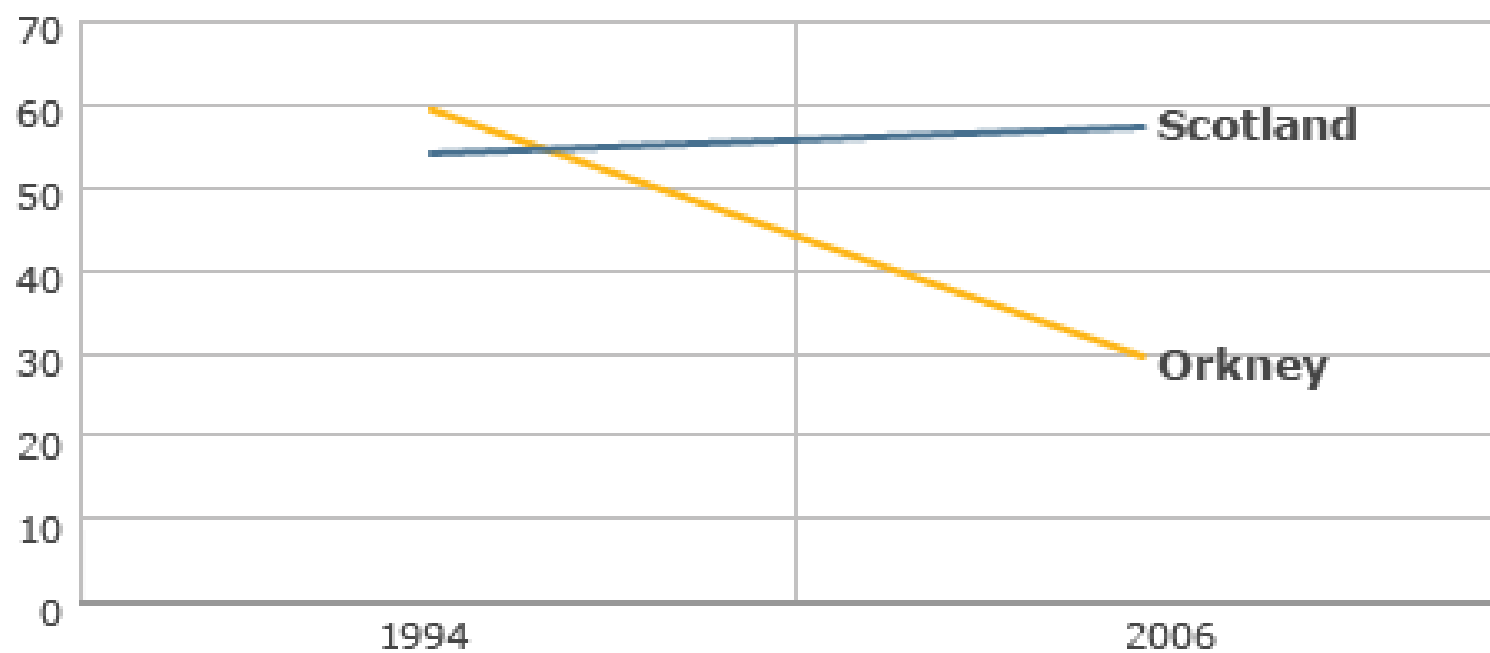
# Recap

# Problem Session 2

- Prosecutors Fallacy
- <http://www.theguardian.com/uk/2003/jan/30/ukcrime.taniabranigan>
- Teen Pregnancies
- [http://news.bbc.co.uk/1/hi/scotland/highlands\\_and\\_islands/8073335.stm](http://news.bbc.co.uk/1/hi/scotland/highlands_and_islands/8073335.stm)
- Sports Illustrated
- 6. The Sports Illustrated Cover Curse
- **Origin:** Eddie Mathews, the first athlete on the cover of *Sports Illustrated*, breaks his hand  
**Teams/people involved:** Various athletes depicted on the cover of *Sports Illustrated*  
**Year started:** 1954
- Even from the very first cover, *Sports Illustrated* has been known for having some strange incidents occur in relation to their cover athletes. For the first issue, it was former Braves star Eddie Mathews, who would end up suffering a broken hand shortly after he was placed on the cover. After that, Jill Kinmont's paralysis in 1955—which occurred during the same week that she was on the cover of *SI*—added to the list of tragic and untimely accidents.
- Since these two initial incidents, a storied history of trouble or bad luck has emerged in connection with *Sports Illustrated*, giving way to the belief that a jinx is associated with the magazine. Though no specific origin has been named as the reason for the curse, the common consequences that these athletes have suffered suggests a common cause to some.

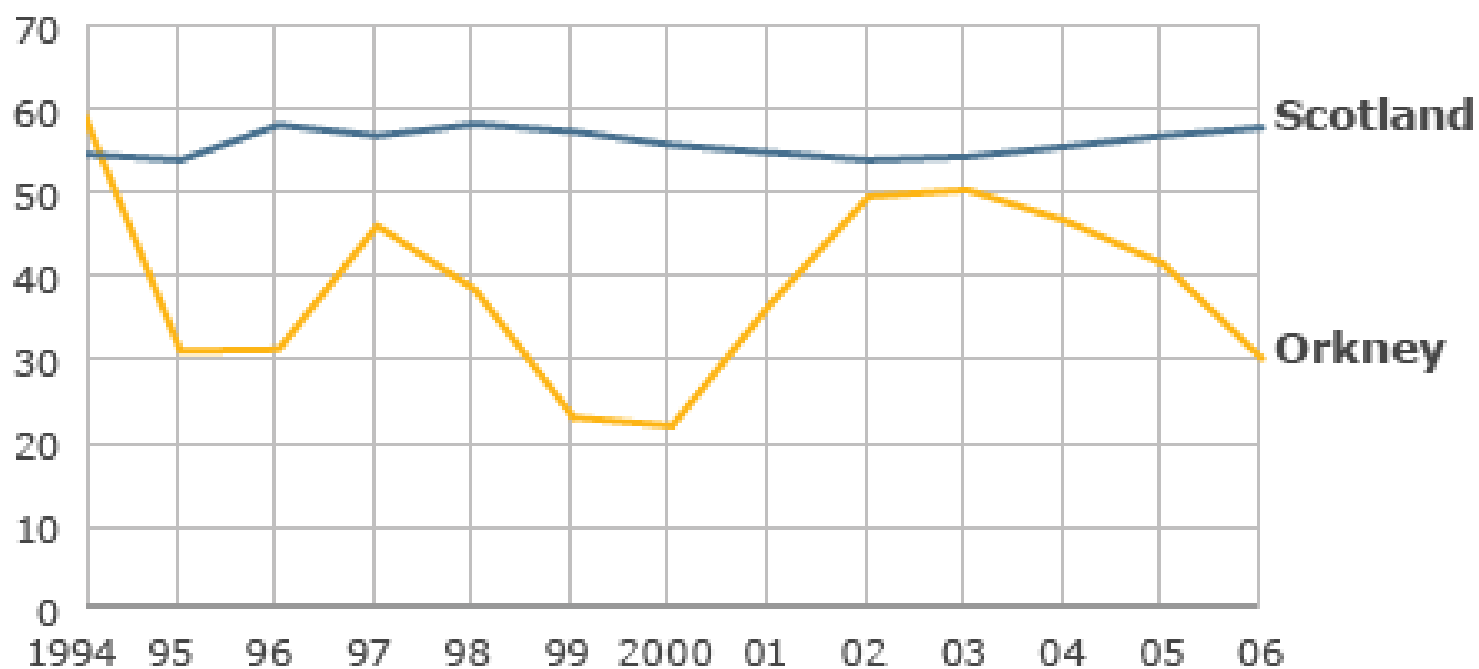
## Teenage pregnancies

Per thousand women



## Teenage pregnancies

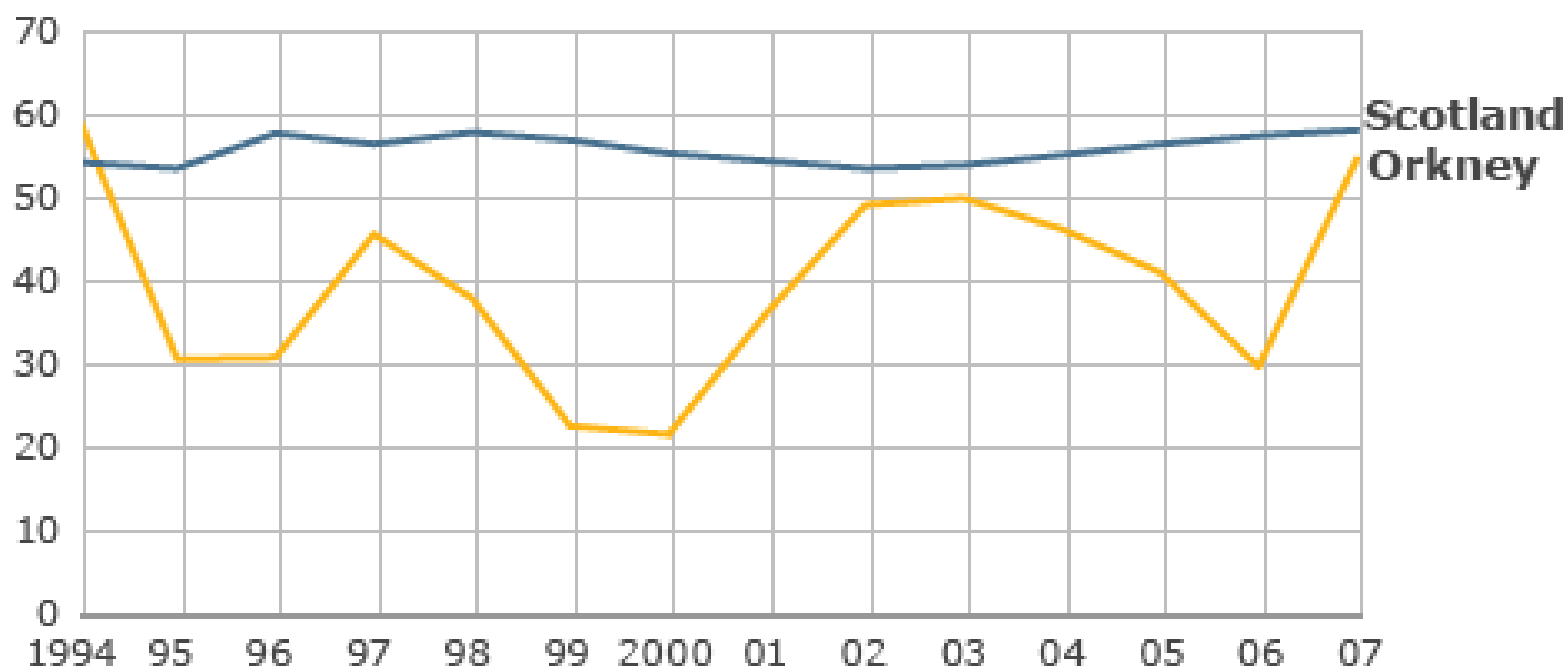
Per thousand women





## Teenage pregnancies

Per thousand women



# Are there dangers in breast cancer screening?



# Tests can be wrong

- Say that routine screening is 90% accurate. Say you have a positive test. What's the chance that your positive test is accurate and you really have cancer?



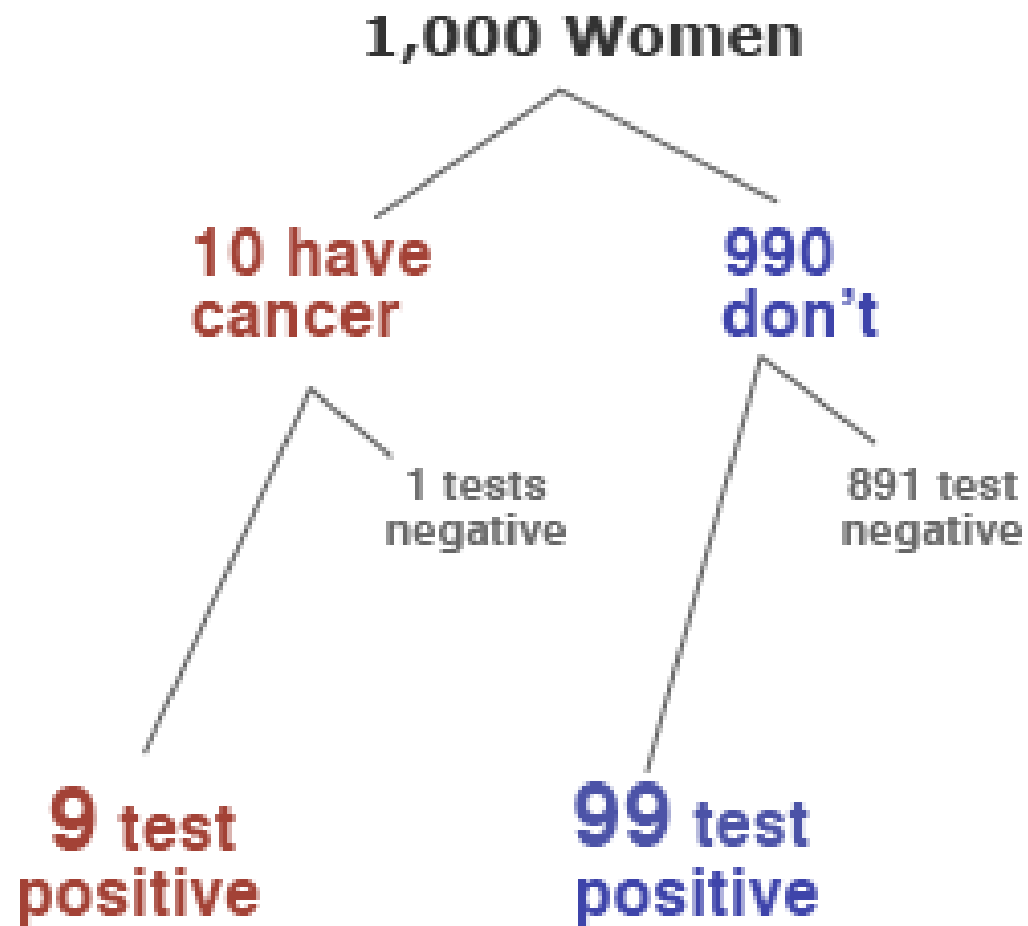
- 10 out of 1000 women at age forty who participate in routine screening have breast cancer. 9 of every 10 women with breast cancer will get a positive mammography. 99 out of 9,90 women without breast cancer will also get a positive mammography. If 1,000 women in this age group undergo a routine screening, about what fraction of women with positive mammographies will actually have breast cancer?

# Bayes' Theorem

$$P(A|B) = \frac{P(B|A) P(A)}{P(B)}$$







**2,000 Women**

**20 have cancer**

**1980 don't have cancer**

17 would be spotted and treated successfully without screening, or would die despite treatment, or would die from something else

2 missed

**1** life saved by screening

**198**  
positive

**1782**  
negative

**10** treated unnecessarily

**188** cleared by further testing, biopsy etc.

- <http://understandinguncertainty.org/files/animations/BayesTheorem1/BayesTheorem.html>