

Bernoulli Probabilities and Binomial Plotting

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Bernoulli Probabilities

If you want to model the question, what is the probability of tossing a coin 8 times to obtain sequence HHTTTHTT? (2H3TH2T)

$$f(x) = P(X = x) = B(n, p) = \binom{n}{x} \cdot p^x \cdot q^{n-x} = \frac{n!}{x!(n-x)!}$$

Model it as a binomial, consider 'H' = probability of success, with 8 independent trials with a probability of success=0.5.

In R, `dbinom(k,n,p)`

```
dbinom(x=5,size=8,prob=0.5)
```

```
## [1] 0.21875
```

Binomial Distribution

Think of the binomial distribution as the sum of repeated Bernoulli trials.

```
df = data.frame(oneThird=dbinom(x=xSeq, size=20, prob=1/3), oneHalf=dbinom(x=xSeq, size=20, prob=1/2),  
#df = data.frame("probability0.333=dbinom(x=xSeq, size=20, prob=1/3), "probability0.5=dbinom(x=xSeq,  
dfS=stack(df)
```

```
library('ggplot2')  
library('grid')  
ggplot(data=dfS, aes(x=Xvalue, y=Freq)) +  
  geom_bar(stat = "identity", col = "purple", fill = "lightblue") +  
  scale_y_continuous(expand = c(0.01, 0)) +  
  xlab("x") + ylab("Density") +  
  labs(title = "Binomial Distribution\nvarying values of P") + theme_bw(16, "serif") +  
  facet_wrap(~ Prob, ncol=2) +  
  theme(panel.margin = unit(2, "lines")) +  
  theme(plot.title = element_text(size = rel(1.2), vjust = 1.5))
```

Binomial Distribution varying values of P

