(3b) $P(\text{same} \mid 2^{\text{nd}} \text{ red}) = \dfrac{P(\text{same} \cap 2^{\text{nd}} \text{ red})}{P(2^{\text{nd}} \text{ red})}$

$$= \frac{\cancel{\frac{3}{10}} \cdot \frac{2}{9}}{\cancel{\frac{3}{10}}} = \frac{2}{9}$$

(5) $P(C \cap D) = P(C) + P(D) - P(C \cup D) = 0.15$

$P(C) \cdot P(D) = 0.1$

$$P(C \mid D) = \frac{P(C \cap D)}{P(D)} = \frac{0.15}{0.4} = \frac{15}{40} = \frac{3}{8}$$

(6)

$$\overset{4.5}{} \qquad \overset{8.5}{} \qquad \overset{13.5}{}$$

$1, 2, 4, \mid 5, 7, 8, \mid 9, 11, 13, \mid 14, 16, 20$

$IQR = 13.5 - 4.5 = 9$

$$7(c)\quad P(B\mid D) = \frac{\cancel{P(B\cap D)}\ \ \cancel{\tfrac{3}{4}}\cdot\tfrac{1}{3}}{\cancel{P(D)}\ \ \tfrac{5}{\cancel{12}\,3}} = \frac{3}{5}$$

S_x

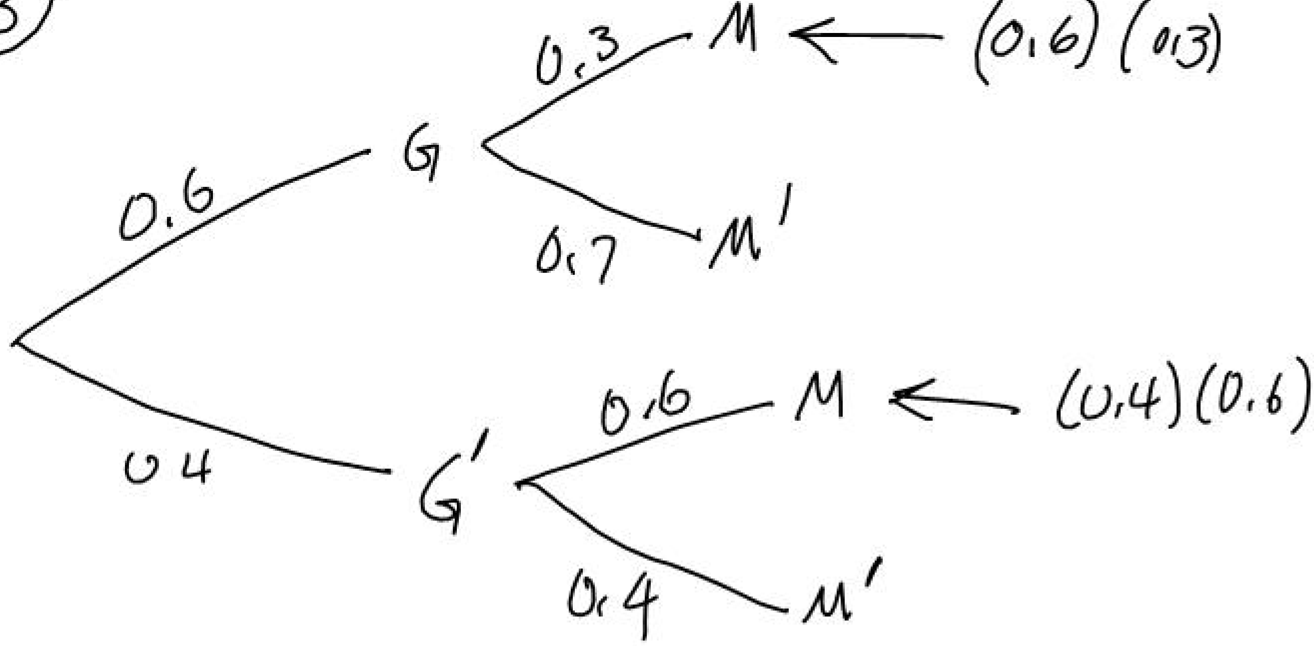
σ_x

$$\frac{12!}{2!\,2!\,2!}$$

T

$$\frac{\dfrac{\cancel{11!}}{\cancel{2!}\,\cancel{2!}}}{\dfrac{\cancel{12!}\ 12}{\cancel{2!}\,\cancel{2!}\,2!}} = \frac{2}{12} = \frac{1}{6}$$

3



$$P(G \mid M) = \frac{P(G \cap M)}{P(M)}$$

$$= \frac{(0.6)(0.3)}{(0.6)(0.3)+(0.4)(0.6)} = \frac{3}{7}$$

0.429

The Binomial Theorem

Ex. $\left(x^2+\frac{2}{x}\right)^4 = \left(x^2+\frac{2}{x}\right)\left(x^2+\frac{2}{x}\right)\left(x^2+\frac{2}{x}\right)\left(x^2+\frac{2}{x}\right)$

$$= (x^2)^4 + \overset{4}{\binom{4}{3}} \cdot (x^2)^3 \overset{2}{\left(\frac{2}{x}\right)^1} + \overset{6}{\cancel{\binom{4}{2}}} (x^2)^2 \left(\frac{2}{x}\right)^2$$

$$+ \overset{4}{\binom{4}{1}} \cdot (x^2)^1 \overset{8}{\left(\frac{2}{x}\right)^3} + \left(\frac{2}{x}\right)^4$$

$$= x^8 + 8x^5 + 24x^2 + \frac{32}{x} + \frac{16}{x^4}$$

Ex. $\left(\frac{1}{3}+\frac{2}{3}\right)^5$

$$= \left(\frac{1}{3}\right)^5 + \overset{5}{\cancel{\binom{5}{4}}} \cdot \left(\frac{1}{3}\right)^4 \overset{2}{\left(\frac{2}{3}\right)} + \overset{10}{\cancel{\binom{5}{3}}} \cdot \left(\frac{1}{3}\right)^3 \overset{4}{\left(\frac{2}{3}\right)^2}$$

$$+ \overset{10}{\cancel{\binom{5}{2}}} \cdot \left(\frac{1}{3}\right)^2 \overset{8}{\left(\frac{2}{3}\right)^3} + \overset{5}{\cancel{\binom{5}{1}}} \cdot \left(\frac{1}{3}\right) \overset{16}{\left(\frac{2}{3}\right)^4} + \left(\frac{2}{3}\right)^5$$

$$= \frac{1}{243} + \frac{10}{243} + \frac{40}{243} + \frac{80}{243} + \frac{80}{243} + \frac{32}{243}$$

EX. Roll 5 dice. Count the number of ⚀ and ⚁ that show.

Let random variable X = the number of ⚀s + ⚁s

Make a probability distribution table for X.

X	0	1	2	3	4	5
$P(X=x)$	$\frac{32}{243}$	$\frac{80}{243}$	$\frac{80}{243}$	$\frac{40}{243}$	$\frac{10}{243}$	$\frac{1}{243}$

$$\boxed{X \sim B\left(5, \tfrac{1}{3}\right)}$$

$$E(X) = \frac{1}{3}(5) = 1\tfrac{2}{3}$$

$$\binom{5}{2}\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)\left(\frac{2}{3}\right)$$

$$\binom{5}{2}\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^3 = \frac{80}{243}$$

We say X has a binomial distribution

- There are only 2 outcomes: success / failure
- There is a fixed number of trials (n)
- The probability of success is fixed (p)
  (The prob. of failure is $q = 1 - p$)

Ex. $Y \sim B\left(25, \frac{1}{2}\right)$ $\qquad \left(\frac{1}{2}+\frac{1}{2}\right)^{25}$

a) $P(Y=12) = \binom{25}{12}\left(\frac{1}{2}\right)^{12}\left(\frac{1}{2}\right)^{13}$

$= \text{binomialpdf}(25, 1/2, 12)$

$(n, p, \text{\# of successes})$

b) $P(Y \leq 10) = \text{binomialcdf}(25, 1/2, 10)$

$= 0.212$

c) $P(Y < 15) = P(Y \leq 14) = 0.788$

d) $P(Y > 14) = 1 - P(Y \leq 14) = 0.212$

$\boxed{10D}$ #1a X = # of heads on 10 coins

$P(X=4) = \binom{10}{4}\left(\frac{1}{2}\right)^4\left(\frac{1}{2}\right)^6 = 0.205$

6. $X \sim B(n, 0.3)$

$P(X > 3) = 1 - P(X \leq 3)$

$= 1 - \text{binomialcdf}(n, 0.3, 3)$

The Mean and Variance of a Distribution

$\mu = E(X)$ = the expected value of X

For a Binomial distribution, $E(X) = np$

Variance is a measure of spread: $Var(X) = npq$

HW 10D #1-3, 5, 7

10E # 1
