Q1

[Maximum mark: 5]

Let $f(x) = a(x-h)^2 + k$. The vertex of the graph of f is at (3,4) and the graph passes through (1,-4).

h K

(a) Write down the value of h and k. [2

(b) Find the value of a. [3

$f(x) = a(x-3)^2 + 4$

$-4 = a(1-3)^2 + 4$

$-8 = a(4)$

$-2 = a$

PRIOR KNOWLEDGE NEEDED:

① calculate the mean of a frequency distribution:

x	0	1	2	3
Freq.	3	6	9	2

$$\bar{x} = \frac{\sum f(x)}{\sum f} = \frac{(0\times3)+(1\times6)+(2\times9)+(3\times2)}{3+6+9+2}$$

$$= 1.5$$

② Evaluate $\binom{5}{2} = \frac{5!}{(2!)(3!)}$

combination

${}_nC_r$

③ Solve $\frac{x-2.5}{1.2} = 0.4$ $\quad x = 2.98$

Chapter 15: Probability Distributions

15.1 Random Variables

Random Variable: a quantity whose value depends on chance

p(X) A (capital letters)

Discrete Random Variable: a random variable that has a **finite** number of possible values (ie. # of kids, sides to a die)

Continuous Random Variable: can take on any value in an interval (ie. miles driven, time to complete a task.)

def A PROBABILITY DISTRIBUTION FOR A DISCRETE RANDOM VARIABE IS A LIST OF EACH POSSIBLE VALUE OF THE RANDOM VARIABLE AND THE PROBABILITY THAT EACH OUTCOME OCCURS.

Ex X IS THE NUMBER OF SIXES OBTAINED WHEN A FAIR DIE IS ROLLED 3 TIMES.

X	0	1	2	3
$P(X=x)$	$\frac{125}{216}$	$\frac{25}{72}$	$\frac{5}{72}$	$\frac{1}{216}$

add up + 1

6's / # of rolls

HW 15A P. 522 #5, 7, 8

Ex X IS DISTRIBUTED:

X	1	2	3	4	5
$P(X=x)$	$7c$	$5c$	$4c$	$3c$	c

a) find the value of $c = \frac{1}{20}$ $7c+5c+4c+3c+c=1$, $20c=1$, $c=1/20$

b) Find $P(X \geq 4) = 3\left(\frac{1}{20}\right)+1\left(\frac{1}{20}\right) = \frac{1}{5}$

Expected Value

$$E(X) = \sum x \, P(X = x)$$

X	0	1	2	3
$P(X=x)$	$\frac{125}{216}$	$\frac{25}{72}$	$\frac{5}{72}$	$\frac{1}{216}$

$$E(X) = 0\left(\frac{125}{216}\right) + 1\left(\frac{25}{72}\right) + 2\left(\frac{5}{72}\right) + 3\left(\frac{1}{216}\right)$$

$$= \frac{1}{2}$$

X	0	1	2	3
$P(X=x)$	$\frac{125}{216}$	$\frac{25}{72}$	$\frac{5}{72}$	$\frac{1}{216}$

HW 5B p. 525 #3, 7, 10

15.2 The Binomial Distribution

Two laws

2 possible outcomes (Probability)

Success/Failure

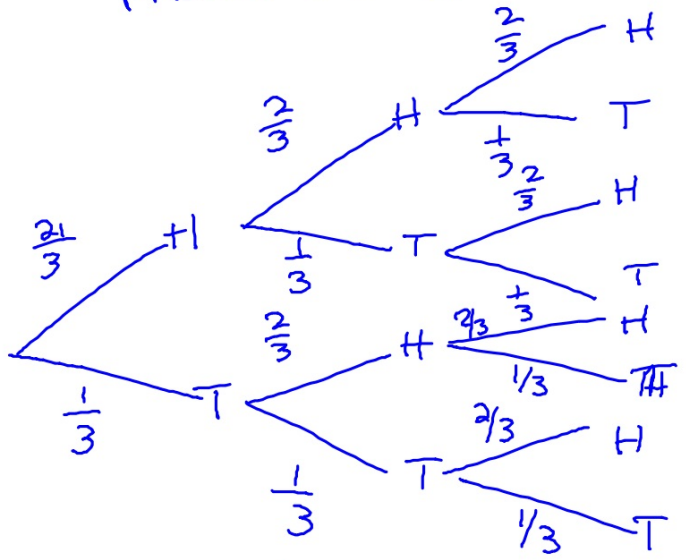
ie: boy/girl H/T

REQUIRED ELEMENTS

- FIXED # OF TRIALS
- TWO POSSIBLE OUTCOME
- THE PROBABILITY (p) OF SUCCESS IS THE SAME FOR EVERY TRIAL
- TRIALS ARE INDEPENDENT OF ONE ANOTHER.

[Ex] FLIP A COIN 3 TIMES

PROBABILITY OF EXACTLY TWO HEADS (BIASED COIN)



HHH	$(\frac{2}{3})^3$
HHT	$(\frac{2}{3})^2(\frac{1}{3})$
HTH	$(\frac{2}{3})^2(\frac{1}{3})$
HTT	$(\frac{2}{3})(\frac{1}{3})^2$
THH	$(\frac{2}{3})^2(\frac{1}{3})$
THT	$(\frac{2}{3})(\frac{1}{3})^2$
TTH	$(\frac{2}{3})(\frac{1}{3})^2$
TTT	$(\frac{1}{3})^3$

$P(2 \text{ Head in } 3 \text{ rolls}) = P(HHT) + P(HTH) + P(THH) = 3\left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)$

what about 6 ~~flips~~ coins?

$P(HHTTTT) = \left(\frac{2}{3}\right)^2\left(\frac{1}{3}\right)^4$ (15)

2 4

IF X IS BINOMIALLY DISTRIBUTED, $X \sim B(n, p)$

THEN THE PROBABILITY OF r SUCCESSES OUT OF n TRIALS, WHEN p IS THE PROBABILITY OF SUCCESS FOR EACH TRIAL IS

Binomial Dist. # of trials prob. of success

$$P(X=r) = \binom{n}{r} p^r (1-p)^{n-r}$$

Ex) X is BD with $n=6$ and $p = \frac{1}{5}$

without GDC, determine $P(X \leq 3)$

(3 or fewer successes)

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

$p = \frac{1}{5}$ $q = \frac{4}{5}$

4 N

$P(X=0) = \binom{6}{0}\left(\frac{1}{5}\right)^0\left(\frac{4}{5}\right)^6$

$P(X=1) = \binom{6}{1}\left(\frac{1}{5}\right)^1\left(\frac{4}{5}\right)^5$

$P(X=2) = \binom{6}{2}\left(\frac{1}{5}\right)^2\left(\frac{4}{5}\right)^4$

$+ \quad P(X=3) = \binom{6}{3}\left(\frac{1}{5}\right)^3\left(\frac{4}{5}\right)^3 = \frac{6!}{3!(6-3)!}\left(\frac{1}{5}\right)^3\left(\frac{4}{5}\right)^3$

0.98304

2nd Vars (Distr)

binompdf (trials, prob, #)
gives exact prob for

binomcdf (n, p, x)
give cummulative prob
for 0, 1, 2, ... X

Hw 15 @ p.531 #1-3

Calculator instruction link:

http://users.rowan.edu/~schultzl/TI/binomial_StatI.pdf