ch5
↓
6.1 Random variables 12/04/2023
X

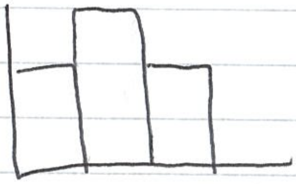
-QUANTAATIVE

Discrete Random Variables
-quantitative, but countable (integers) ~ whole/negative/0
Continuous Random Variables
-quantitative, but infinite/not countable ~fractions/decimals

pg198 EXAMPLE 1
Measure the time it takes a student selected at random to register for the fall term – continuous

Count the number of bad checks drawn on Upright Bank on a day selected at random – discrete

Probability Distributions



-add to +1 because
no gaps and no overlaps
↑ └ ∃xS
↑ └ disjointed

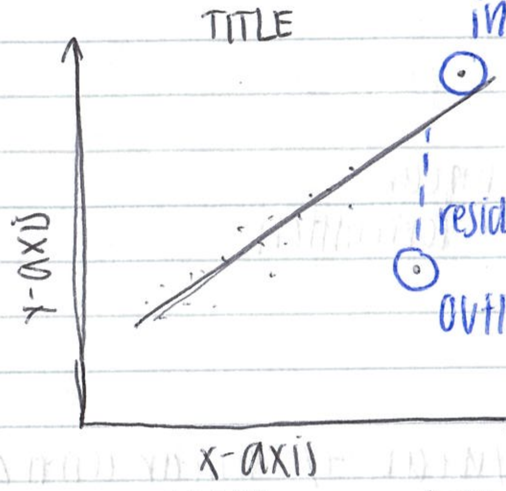
Center and spread
↑
expected value/#
$$\mu = \sum x \cdot p(x)$$
↑
standard deviation
$$\sigma^2 = Var(X) = \sum (x-\mu)^2 \cdot p(x)$$
$$\sigma = SD(X) = \sqrt{\sum (x-\mu)^2 \cdot p(x)}$$

UNIT 4:

(CHAPTER 9)

BIVARIATE DATA: scatterplots, correlation coeffecient, residual plot

SCATTERPLOTS:



influencial observation
- close to LSRL, far from data

residual

outlier - far from LSRL → Least Squares Regression Line or line of best fit

ANA:
+/- association
trend
ins/outs
correlation ★

→ finding the LSRL

1. find b → $b = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$ = slope
2. find a → $a = \bar{y} - b\bar{x}$ = y-int
3. plug into line equation → $\hat{y} = a + bx$
4. plot 2 points
   - → b and $\bar{x}, \bar{y}$
   - → if no b, pick a random #

(→ Example: Σ = sum of $\bar{x}$ = mean

$\bar{x} = 3.25$

$\bar{y} = 38.5$

$\Sigma x = 13$

$\Sigma y = 154$

$\Sigma xy = 411$

$\Sigma x^2 = 65$

$$b = \frac{n\Sigma xy - \Sigma x \Sigma y}{n\Sigma x^2 - (\Sigma x)^2}$$

$$= \frac{4(411) - (13)(154)}{4(65) - 169}$$

$\underline{b = -3.93}$ ①

$a = \bar{y} - b\bar{x}$

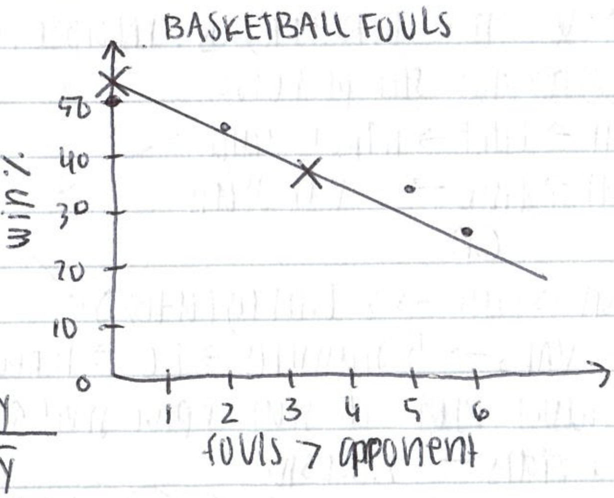
$= 38.5 - (-3.93)(3.25)$

$\underline{a = 51.27}$ ②

$\underline{\hat{y} = 51.27 + (-3.93)x}$ ③

④

x	y
$\bar{x}$	$\bar{y}$
3.25	38.5
0	51.27



UNIT 5:
(CHAPTER 4)

PROBABILITY: compound events, P/C, tree diagram / 2 table

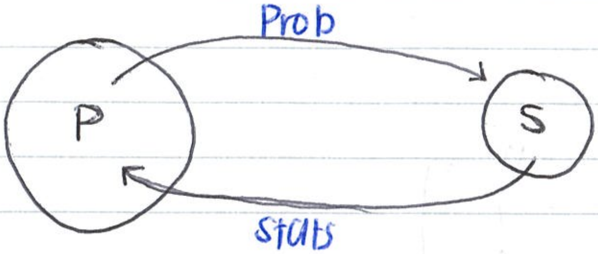
probability – likelihood of an event happening $0 \leq P \leq 1$

$\frac{f}{n} = \frac{\# \text{ of desired}}{\# \text{ of total}}$

↙ impossible   ↘ 1 certainty

complement – P (not the event)

$\therefore P(A') = 1 - P(A)$



odds – ratio

Fav : unfav

Fav : Fav'

conditional probability = $\frac{P(A \text{ and } B)}{P(B)}$

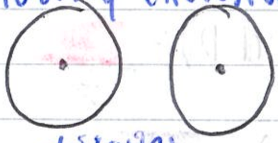
LoL #s – law of large #s

- must use large samples in case of a lucky streak ruins data / makes it more probable than it actually is

sample space = S{set of all possible outcomes}

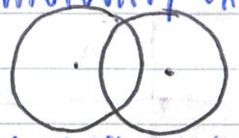
COMPOUND EVENTS:

mutually exclusive



disjoint

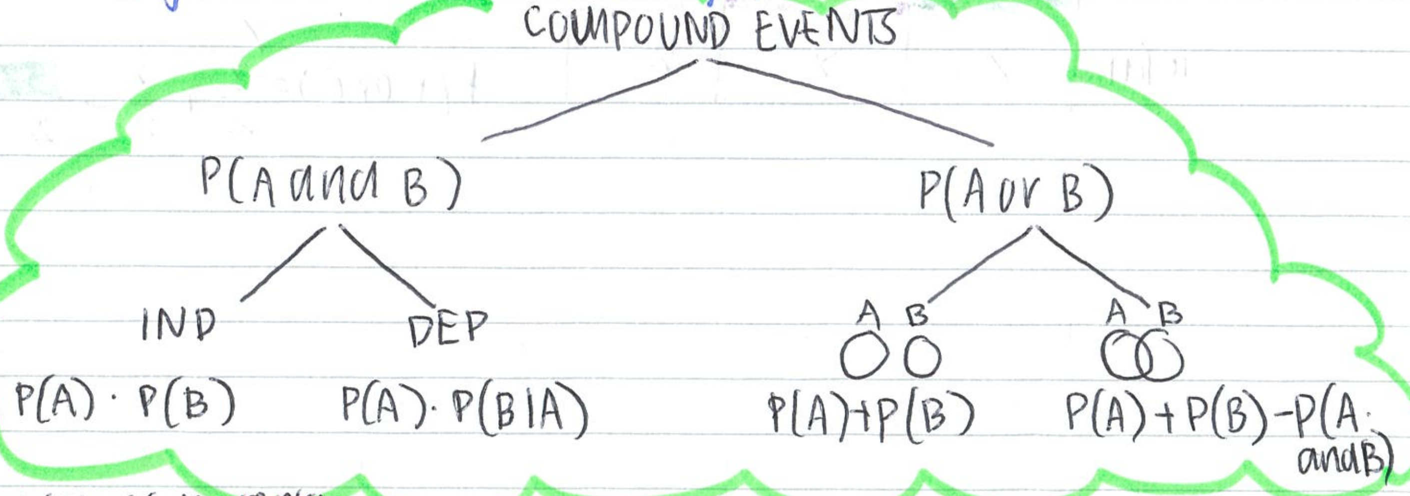
nonmutually exclusive



nondisjoint

∃xS

no gaps / overlaps in sample space



replace vs. no replace

%
↓
6.2 BINOMIAL EXPERIMENTS 12/08/23

pg 212 STUDY GUIDE:

1. Who was Jacob Bernoulli?
17th century swiss math matician

2. The sort of problem which have exactly 2 possible outcoms is called
$S = \{Y, N\}$ binomials

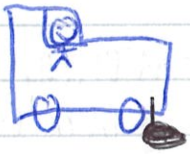
3. Describe the central problem of a binomial experiment
probability $\frac{r\text{(successes)}}{n\text{(trials)}}$

4. T [✓ F] Binomial experiments work only w/ dependent situations

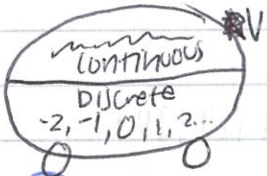
5. Each faculty member @ Pepperdine has been asked abt recommending which new car Mr. Milek should purchase: 500 members

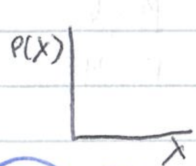
# of trials, $n = 500$
# of possible outcomes =
Binomial Experiment?
no. more than 2 outcomes

amount of cars



Discrete Random variable RVs
μ = expected value
σ





Bi

$\mu = \Sigma x \cdot p(x)$

$\sigma = \sqrt{\Sigma (x-\mu)^2 \cdot P(x)}$

Success/Fail
independent
n (predetermined # of trials)
$P = \overset{\text{goal}}{\text{published research}}$
central probability $\frac{r}{n}$

TABLE WAY

HYBRID TOMATO   Table 3 $n=6$

$n=6$ $p=0.7$ $q=0.3$ $r=4$

$0.324 = P(r=4)$

$P(r \geq 4) = 0.324 + 0.303, + 0.118$

$= 0.745$

CALC WAY

$P(r=8)$ POP QUIZ a,b,c,d,e

$n=10$ $r=8$ $p=0.2$ $q=0.8$

$P(r=8) = 7.37 \times 10^{-5}$

≈ 0

2nd → vars

A: binompdf(

EDPUZZLE NOTES: THE BINOMIAL DISTRIBUTION CC 12/15

Binomial Distribution Formula:

$binom(n,k) = {}_nC_k (p)^k (1-p)^{n-k}$ video's

$C_{n,r}(p)^r(1-p)^{n-r}$ ours / textbook's

Binomial Coefficient Formula - how many ways a certain ratio of successes to failures can occur

${}_nC_k$ aka ${}_nC_r$

n choose k

Factorials! $\frac{n!}{(n-k)!k!}$

expected # = n x p

Bernoulli Distribution

$P(X=1)\ p^1(1-p)^{1-1} = p$ success

$P(X=0)\ p^0(1-p)^{1-0} = (1-p)$ fail

5.2 #18 one-time thing! (with clothes)

trial = 

ind? yes

$p = 0.1$

$q = 0.9$

S = "yes"

F = "no"

$n = 7$

$r = 2$

$P(r) = C_{n,r}\, p^r q^{n-r}$

$P(r=2) = C_{7,2}(0.1)^2(0.9)^{7-5}$

$= 21(0.01)(0.5905)$

$P(r=2) =$ ~~0.24~~ 0.1240

$P(r \leq 2) = P(0) + P(1) + P(2)$

$0.4783 + 0.3720 + 0.1240$

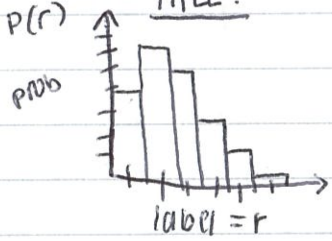
$P(r \leq 2) = 0.9743$

TABLE WAY:

$P(2 \leq r \leq 6) = 0.124 + 0.023 + 0.003 + 0.000 + 0.000$

$= 0.15$

TITLE:



ANA

C: $\overset{ean}{M} = 1.5$

Shp: skewed high

Spr: $\sigma = 1.0607$

O: 4⁺ "mod. high"

$n = 6$

$P = 0.25$

r = 0	= 0.178
1	= 0.356
2	= 0.~~303~~ 297
3	= 0.132
4	= 0.033
5	= 0.004
6	= 0.000

table

5.1

$\mu = \Sigma x \cdot p(x)$

$\mu = np = 6(0.25)$

$\sigma = \sqrt{npq} = \sqrt{\mu q}$

AA (an appreciation)

MC Escher 40 years p=0.8 P/F ind 20 sts

CB GEOMETRIC DISTRIBUTIONS VID 12/14/23

HURRICANE EX

2 < S = tropical storm → hurricane   41% TS → H
F = tropical storm   P(4th TS → 1st hurricane)

hurricane = 74+ mph   p = 0.41   ↳ binomial would be 1/4 instead of 1st 1/4

independent   q = 0.59

H = # tropical storms to get first hurricane

GEOMETRIC:
- 2 outcomes (F/S)
- independent trials
- each trial has same prob of S

BINOMIAL:
- fixed # of trials

$$\underset{\uparrow}{P(H=4)} = \underbrace{(1-0.41)(1-0.41)(1-0.41)}_{\text{fail}}\underset{\substack{\uparrow\\ \text{success}}}{(0.41)} = 0.0842$$

probability notation

$$\boxed{P(X=x) = (1-p)^{x-1}p \text{ for } x = 1,2,3,\ldots}$$

↳ $\boxed{q^{n-1}p}$

Cumulative Geometric Prob:

P(H ≤ 3)

P(x = 4) = geompdf(p = 0.53, x = 4) = 0.055

Mean: $\boxed{\mu_x = \frac{1}{p}}$ SD: $\boxed{\sigma_x = \frac{\sqrt{1-p}}{p}} \rightarrow q$

8.26 ~ PACKET

S= defective disk drive 1st messed up on the 5th
F= working / not ddd
independent
X = # of disks until the first ddd is the 5th unit tested
$p = 0.03$ $n = ??$
$q = 0.97$ stop @ 1st success

x	1	2	3	4	5
p(x)	0.03	f·s q·p 0.97·0.03 0.0291	q·q·p 0.0282	0.0274	0.0266

$q^{n-1}p$

8.41 COIN TOSS

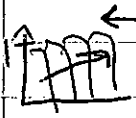
1 2 3
S { h h h
h h t
h t h
t h h
t t h
t h t
h t t
t t t

"wins" ↳ 1 odd man

a.) 0.25
p=
6/8 = 0.75
q = 0.25

d.)

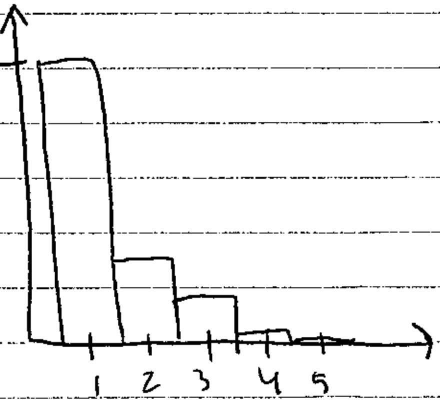
x	1	2	3	4	5
P(x)	0.75	0.1875	0.0469	0.0117	0.0029
cumu	0.75	0.9375	0.9844	0.9961	0.9990



←

$\mu = \frac{1}{0.75} = 1.33$

$\sigma = \frac{\sqrt{1-p}}{p} = 0.67$



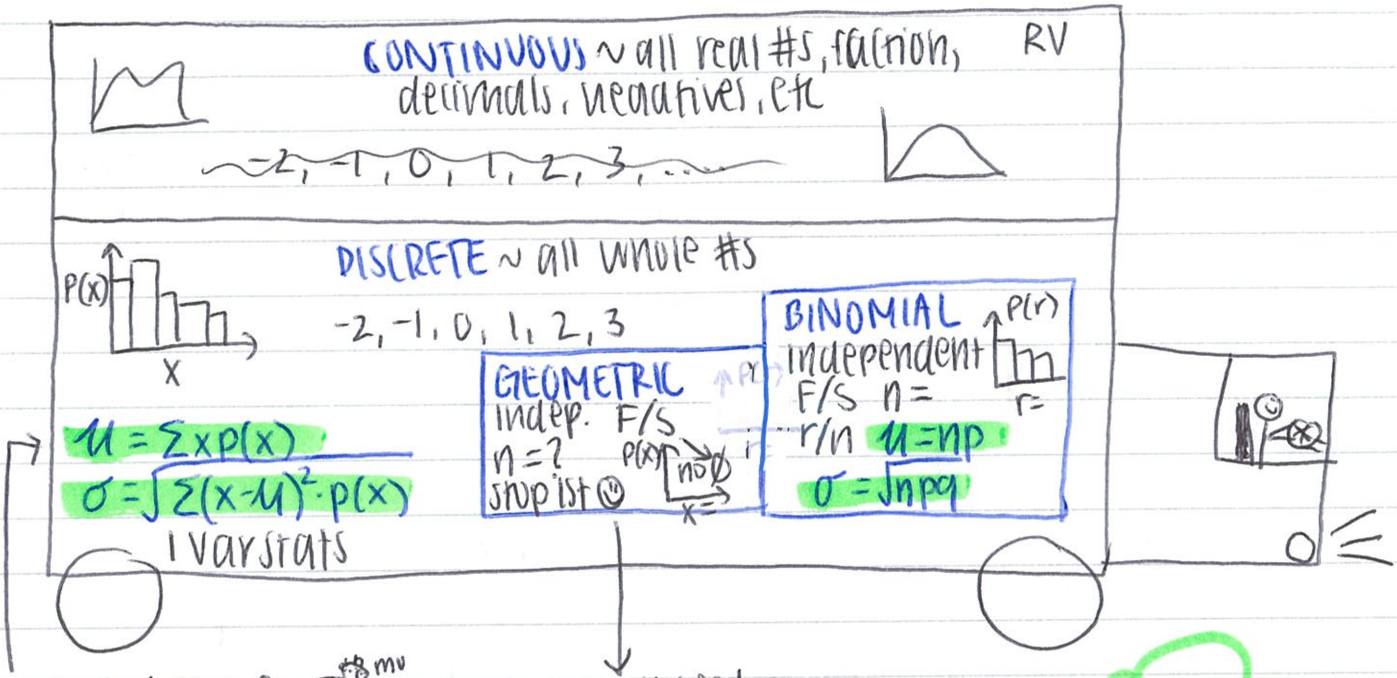
chapter 5 (Unit 6) REVIEW PROBS 12/18/23

pg 242 #26 EXTROVERTED PROFESSOR
BIONOMIAL
trial = testing a professors personality
s= extroverted
F= introverted
P= 0.45
n=6 P(r=6)= 0.0083 .83% highly unlikely
r=6

UNIT 6:

(CHAPTER 5)

Random variations, Probability Distributions, Binomials, Geometric



CONTINUOUS ~ all real #s, faction, decimals, negatives, etc

RV

-2, -1, 0, 1, 2, 3, ...

DISCRETE ~ all whole #s

-2, -1, 0, 1, 2, 3

$\mu = \Sigma x p(x)$

$\sigma = \sqrt{\Sigma (x-\mu)^2 \cdot p(x)}$

1 varstats

GEOMETRIC
indep. F/S
n = ?
stop 1st ☺

BINOMIAL
independent
F/S n =
r/n $\mu = np$
$\sigma = \sqrt{npq}$

expected value

p = success
q = fail

can't succeed on 0th trial!

$\mu = \frac{1}{p}$

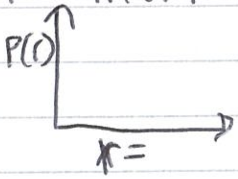
$\sigma = \frac{\sqrt{q}}{p}$

$P(x>n) = (1-p)^n$

ANA:
C: μ =
S:
S: σ ~ word
O: < 5%

→ **BINOMIAL**

EQUATION METHOD: $C_{n,r}\, p^r q^{n-r}$ ★ # + likeliness
TABLE METHOD: n = ? p = ? add em up
CALCULATOR METHOD: 2nd → vars
A: binompdf

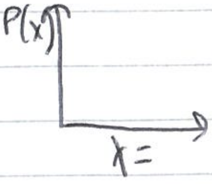


→ **GEOMETRIC** ~ stop until success ★ Prob. Notation + # + likeliness

pq^{n-1}

define X
EX: X = # of litters born to get 1st large family

x	1	2	3	4
p(x)	p	q·p	q·q·p	q·q·q·p



OR: 2nd → var
F: geometpdf

DISCRETE VALUE REVIEW 1/10/24

ⓒ	x	P(x)	X·p(X)
H	~~$2~~ 1	0.5	~~1~~ 0.5
T	~~$0~~ -1	0.5	~~0~~ -0.5
			1 0

$\mu = \Sigma x p(x)$

~~⚀~~	~~x~~	~~1/6~~ ~~p(x)~~
~~2~~		~~1/6~~
~~3~~		~~1/6~~
~~4~~		~~1/6~~
~~5~~		~~1/6~~
~~6~~		~~1/6~~

	x	p(x)
⚀	~~$10~~ $8	1/6
2	$-2	1/6
3	$-2	1/6
4	$-2	1/6
5	$-2	1/6
6	$-2	1/6

xp(x)
8/6
-2/6
-2/6
-2/6
-2/6
-2/6

$\mu = \Sigma = -2/6 = \$-1/3$

DISCRETE VALUE REVIEW

informercial

$\mu = 2.54$

$\sigma = 1.3669$

1	2	3	4	5
27%	31%	18%	9%	15%

* * *

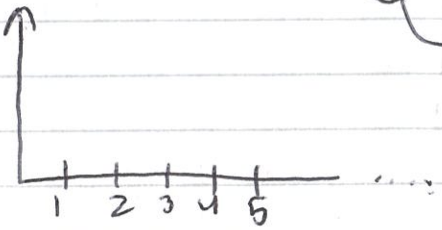
Bad Business

$P(X \leq 3) = P(1) + P(2) + P(3)$

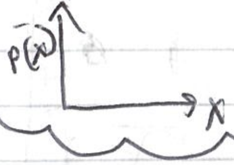
$= 0.02 + 0.07 + 0.15$

$= 0.24$

∃x a 24% that a business will fail within ≤3 years



-notation
-answer
-∃x



$P(X>6) = 0.21$ ∃x 21% chance that a business ends after 6 years

$\mu = 4.98$ years