Math 132 – Statistics – Test # 2 Name

Chapters 4, 5, 6 / ~~Nov 8~~/06

12.5 3

1)

Which of the following is false?

i) a. $13! = 13 \cdot 12 \cdot 11 \cdot 10!$ b. ${}_8P_2 = 28$

c. $\binom{5}{2} = 10$ d. $\binom{15}{4} = \frac{15 \cdot 14 \cdot 13 \cdot 12}{4 \cdot 3 \cdot 2}$

A multiple choice test has 10 questions with 4 choices for each question. The number of ways a student can answer all 10 questions is:

i) a. $10 \cdot 4$ b. $4^{10}$ c. $10^4$ d. $10 + 4$

ii) In how many ways can a committee hire 3 men and 2 women to be chosen from 7 men and 5 women?

$\binom{7}{3}\binom{5}{2}$ $\frac{7 \cdot \cancel{6} \cdot 5}{\cancel{3 \cdot 2}} \cdot (10)$ $\boxed{350}$ ans

2) a) If two events are independent, they must be mutually exclusive. T or F

b) If $P(A) = 0.52$, $P(B) = 0.35$, and $P(A \cap B) = 0.182$, then events $A$ and $B$ are independent. T or F

$.52(.35) = .182$

4 (c) Given $P(A) = 3/8$, $P(B) = 1/2$, and $P(A \cap B) = 1/4$. Find:

a) $P(A \cup B) = 3/8 + 1/2 - 1/4$

$\frac{3 + 4 - 2}{8} = \boxed{5/8}$

b) $P(A') = \boxed{5/8}$

c) $P(B') = \boxed{1/2}$

d) $P(A' \cap B') = P(\widetilde{A \cup B}) = 1 - 5/8$

$\boxed{3/8}$

T2

1256

 12.56

3a) The probability that a patient's disease is correctly treated is 4/5. If it is correctly treated, the probability that she recovers is 0.75. If it is not treated correctly, the probability that she recovers is 0.5. If the patient recovers, what is the probability that her disease was correctly treated?

$P(C|R) = \frac{P(C \cap R)}{P(R)}$ $P(R) = P(C \cap R) \cup P(C' \cap R)$

$(.75).8 + .2(.5)$

$= \frac{.8(.75)}{.7} = \frac{.6}{.7}$ $.6 + .1 = .7$

$\boxed{.857}$ ans

b) A multiple choice test consists of 7 questions with 5 choices each. If a student guesses on all questions, the probability that the student will get exactly 3 correct answers is given by:

a. $\binom{7}{3}\left(\frac{3}{5}\right)^3\left(\frac{2}{5}\right)^4$

b. $\binom{7}{5}\left(\frac{1}{3}\right)^5\left(\frac{2}{3}\right)^2$

c. $\binom{7}{5}\left(\frac{1}{5}\right)^3\left(\frac{4}{5}\right)^4$

d. $\binom{7}{3}\left(\frac{1}{5}\right)^3\left(\frac{4}{5}\right)^4$

c) According to Chebyshev's Theorem, the probability that a random variable will take on a value within 5 standard deviations of the mean is:

a. at most 4/5

b. at least 4/5

c. at most 24/25

d. at least 24/25

$1 - \frac{1}{5^2} = \frac{24}{25}$

omit

d) A department store handled 450 credit card transactions today. History has shown that about 2% of all credit card transactions are fraudulent. On a given day what is the probability that there were more than three fraudulent credit card transactions today.

Change 1

$P(f) = .02$

$P(m>3) = P(0) + P(1) + P(2) + P(3)$

$np = \mu$ $.02(450) = 9$

use poisson $np < 10$

$\sigma = \sqrt{.02(.98)(450)} \sim 2.97$ $P(0) = \frac{(9)^0 e^{-9}}{0!} =$ $P(1) = \frac{(9)^1 e^{-9}}{1!}$

$.0001234 + .00111 = .00125$

4) The following table gives the probability distribution for the number of bicycles sold by a small neighborhood bicycle store in a typical day.

| Bicycles Sold | 0 | 1 | 2 | 3 | 4 | 5 | x |
|---|---|---|---|---|---|---|---|
| Probability | .1 | .2 | .4 | .15 | .1 | .05 | p |
| | 0 | .2 | .8 | .45 | .4 | .25 | x p |

$\mu = \boxed{2.1}$ ans

Find the mean and the variance of the number of bicycles sold in a day at this store.

$\sigma^2 = \sum x^2 p(x) - \mu^2$

$x^2$: 0 1 4 9 16 25

p: .1 .2 .4 .15 .1 .05

$x^2 p$: $0 + .2 + 1.6$ $1.35 + 1.6 + 1.25 = 6 - (2.1)^2 = \boxed{1.59}$ ans

13m

12.09

Page 3 Test 2 math 132

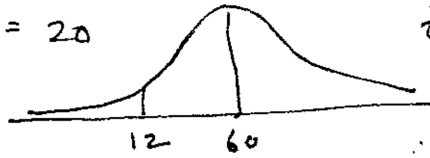
235

5) The lifetime of salmon flies is normally distributed with a mean of 60 days and a standard deviation of 20 days. (use C.C.)

a) {Salmon Flies Lifespan Narrative} What percentage of salmon flies lives less than 12 days?

Omit

$\mu = 60$ $s = 20$

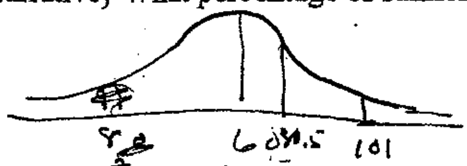



$z = \frac{12-60}{20} = -2.4$

~~$\frac{12.5-60}{20} = -2.375$~~

b) {Salmon Flies Lifespan Narrative} What percentage of salmon flies lives between 80 and 101 days?

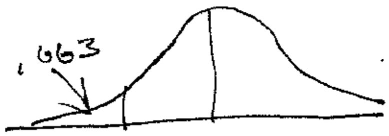
Omit




$\frac{80-60}{20} = 1.0$

$\frac{100.5-60}{20} = 2.025$

c) {Salmon Flies Lifespan Narrative} Find the value $x_0$ such that 6.3% of salmon flies live less than $x_0$ days.




.5000 − .063

.5000 − .0630 = .4370 ⟹ −1.53

$-1.53 = \frac{x-60}{20}$ ans ⟹ $-1.53(20)+60 = x$

$\boxed{28.4 = x}$

6) a. If 600 lottery tickets are sold for a cash prize of \$150, what is the mathematical expectation of a person who buys one of these tickets for \$1?

$ME = \frac{1}{600}(150) - \frac{599}{600}(1) = .25 - .998$ = −.748

Omit (b.) A grab-bag contains 6 packages worth \$2 each, 11 packages worth \$3, and 8 packages worth \$4 each. Is it reasonable to pay \$3.50 for the option of selecting one of these packages at random?

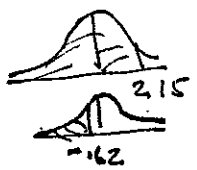
| n | v |
|---|---|
| 6 | 2 |
| 11 | 3 |
| 8 | 4 |

$ME = \frac{6}{25}(2) + \frac{11}{25}(3) + \frac{8}{25}(4)$

$= \frac{12}{25} + \frac{9}{25} + \frac{32}{25} = \frac{53}{25} = 2.72$ NO

7) Find the standard-normal-curve area that lies

(a) to the left of $z = 2.15$;
(b) to the left of $z = -0.62$;
(c) between $z = 1.05$ and $z = 1.85$;
(d) between $z = -0.63$ and $z = 0.63$.




a) .4842 + .5 = $\boxed{.9842}$

b) .5000 − .2324 = .2676

c) .4678 − .3531 = .1147


d) .2357 × 2 = .4614

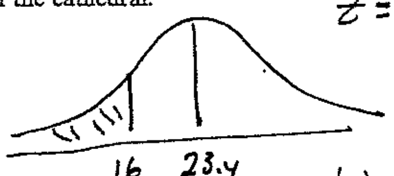
8) If the amount of time a tourist spends in a cathedral is a random variable having the normal distribution with $\mu = 23.4$ minutes and $\sigma = 6.8$ minutes, find the probability that a tourist will spend

Omit (a) at most 16.0 minutes in the cathedral;
(b) anywhere from 20.0 to 30.0 minutes in the cathedral.

a) $z = \frac{16-23.4}{6.8}$ z = −1.054 ⟹ area .3531 ⟹ .114

$\mu = 23.4$

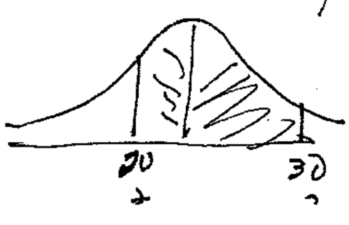
$\sigma = 6.8$




b) $z_1 = \frac{20-23.4}{6.8} = -.5$ areas .1915

$z_2 = \frac{30-23.4}{6.8} \approx .97$ .3340

.5255




17 2.52

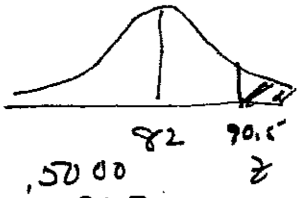
) Use the normal distribution to approximate the binomial probability that more than 90 of 100 scorpion stings will cause extreme discomfort if the probability is 0.82 that any one of them will cause extreme discomfort.

more Than 90 - 91

$\mu = np$

$\mu = 100(.82) = 82$

$\sigma = \sqrt{100(.82)(.18)} = 3.84$



$\frac{90-82}{3.84}$ 2.08 $\Rightarrow$ .5000 − .4812 = .0188

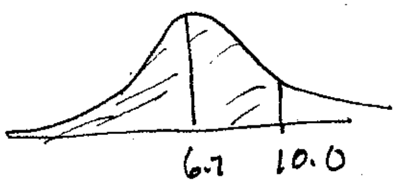
$z = \frac{90.5-82}{3.84} = 2.21$

.5000

Area .4864

.0136

2) In a certain community, the response time of an ambulance may be regarded as a random variable having the normal distribution with $\mu = 6.7$ minutes and a standard deviation of $\sigma = 1.5$ minutes. What is the probability that the ambulance will take at most 10.0 minutes to respond to a call?



$z = \frac{10.0-6.7}{1.5} = 2.2$

Area .4861

.5

.9861 ans

11) Among 80 persons interviewed for certain jobs by a government agency, 40 are married, 20 are single, 10 are divorced, and 10 are widowed. In how many ways can a 10 percent stratified sample be chosen from among the persons interviewed if

(a) one-fourth of the sample is to be allocated to each group;

(b) the allocation is proportional?

40 M
20 S
10 D
10 W

10%(80) = 8

$\frac{8}{80} = \frac{x}{40}$ $\quad$ $\frac{8}{80} = \frac{x}{20}$

a) 2, 2, 2, 2

b) 4, 2, 1, 1

$\binom{40}{2} \cdot \binom{20}{2} \cdot \binom{10}{2} \cdot \binom{10}{2}$

$\binom{40}{4} \cdot \binom{20}{2} \cdot \binom{10}{1}\binom{10}{1}$

12) P(M) = .3 P(N) = .4 and M, N are Mutually Exclusive events find:

a) $P(M \cap N) = \boxed{0}$

b) $P(M \cup N) = \boxed{.7}$

c) $P(M|N) = \boxed{0}$

2.58
2.52
6

18

" 2,59

13) In an article titled "Why Quitting Means Gaining". Time Mag. March 25, 1991 the concern is giving up cigarettes will result in gaining weight.

Data

| Gains | Major | Significant | Moderate | Slight | Totals |
|---|---|---|---|---|---|
| Men | 9% | 14% | 22% | 55% | 100% |
| Women* | 12% | 11% | 26% | 50% | *99% |

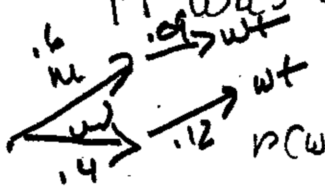
total is not 100%

* due to rounding off - womens

Suppose the group studied was 60% men and 40% women

If a participant is selected at random and found to (i) have a major weight gain find the prob. it was a man.

$$P(M \mid wt) = \frac{P(M \cap wt)}{P(wt)} = \frac{.6(.09)}{.6(.09)+.4(.12)}$$

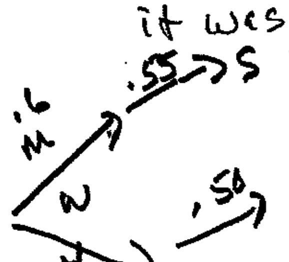



$P(wt) = P(M \cap wt) + P(W \cap wt)$

$$= \frac{.054}{.102} \quad .048 \quad \boxed{.529}$$

(ii) have a slight weight gain. Find the prob it was a women

$$P(W \mid S) = \frac{P(W \cap S)}{P(S)} = \frac{.4(.50)}{.6(.55)+.4(.5)} = \frac{.2}{.53}$$




$\boxed{.377}$

$$P(S) = P(M \cap S) + P(W \cap S)$$
$$= .6(.55) + .4(.50)$$

305

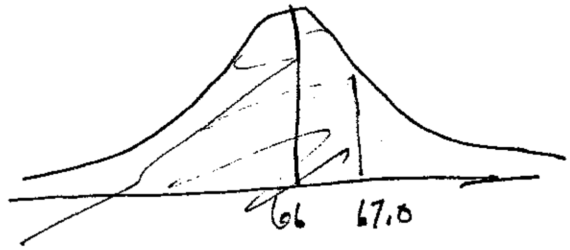
6 min

4) The mean height of students in a certain school is $\mu = 66$ in and $\sigma = 3.7$ in. Find the probability that the mean height of a sample of 40 students is less than 67.0 in.

305

6

$\sigma_{\bar{x}} = \frac{3.7}{\sqrt{40}} = .585$



$z = \frac{67-66}{.585} \approx 1.71 = .4564$

.5

.9564

5)

9

6

mult

b)

According to the Mendelian theory of heredity, if plants with round yellow seeds are crossbred with plants with wrinkled green seeds, the probabilities of getting a plant that produces round yellow seeds, wrinkled yellow seeds, round green seeds, or wrinkled green seeds are, respectively, $\frac{9}{16}$, $\frac{3}{16}$, $\frac{3}{16}$, and $\frac{1}{16}$. What is the probability that among nine plants thus obtained there will be four that produce round yellow seeds, two that produce wrinkled yellow seeds, three that produce round green seeds, and none that produce wrinkled green seeds?

$\binom{9}{4,2,3,0}\left(\frac{9}{16}\right)^4\left(\frac{3}{16}\right)^2\left(\frac{3}{16}\right)^3\left(\frac{1}{16}\right)^0$

If 18 defective glass bricks include 10 that have cracks but no discoloration, five that have discoloration but no cracks, and three that have cracks and discoloration, what is the probability that among six of the bricks (chosen at random for further checks) three will have cracks but no discoloration, one will have discoloration but no cracks, and two will have cracks and discoloration?

a) 10 c b) 5 d

c) 3 CAd

$\frac{\binom{10}{3}\binom{5}{1}\binom{3}{2}}{\binom{18}{6}}$

16) **Which of the following can be probability distributions? Justify your answer.**

6

a. $f(1) = 0.40$, $f(2) = 0.20$, $f(3) = 0.50$ where the random variable can take on only the values 1, 2, and 3. a) NO, $\Sigma p(x) > 1$

b. $f(x) = x/10$ for $x = 0, 1, 2, 3, 4$ b) Yes $0 \le p(x) \le 1$

c. $f(1) = 0.25$, $f(2) = 0.30$, $f(3) = 0.15$, $f(4) = 0.15$ where the random variable can take on only the values 1, 2, 3, and 4

$\Sigma(p(x)) = 1$

d. $f(x) = \frac{x-3}{7}$ for $x = 0, 1, 2, 3, 4, 5$

$\frac{1}{10} + \frac{2}{10} + \frac{3}{10} + \frac{4}{10}$ c) NO $\Sigma < 1$

18

.25
.30
.15
.15

d) NO $p(0)$ is neg

311

6mm

7) a) Chosen at random, 200 rural and 200 urban persons age 65 or older were asked about their health and experience with prescription drugs.

a) Cluster / SRS / stratified

b) After a hurricane, a disaster area is divided into 200 equal grids. Thirty of the grids are selected and every occupied household in the grid is interviewed to help focus relief efforts on what residents require the most.

b) Cluster

c) Chosen at random, 1819 hospital outpatients were contacted and asked their opinion of the care they received.

c) SRS

d) For quality assurance, every twelfth engine part is selected from an assembly line and tested for durability.

d) Systematic

e) Consider this question taken from CNN Quick Vote on the Internet on 7/24/98: In this last season of *Seinfeld,* should Jerry Seinfeld have been nominated for an Emmy? The response was 34% yes, 66% no.

e) Volunteer / Convenience

f) What body of the federal government illustrates a stratified sampling of the people? (A random selection process is not used.)

f) Senate

g) What body of the federal government illustrates a proportional sampling of the people? (A random selection process is not used.)

g) House of Rep.

314
311
3