Name Key

Prob/Stat/Discrete
Unit 5 Practice Test

Provide an appropriate response.

1) State whether the variable is discrete or continuous.
The number of goals scored in a soccer game

$\boxed{\text{Discrete}}$: the # of possibilities is countable, answer is in WHOLE NUMBERS

2) State whether the variable is discrete or continuous.
The speed of a car on a Los Angeles freeway during rush hour traffic

$\boxed{\text{Continuous}}$: infinite # of possible responses because it can be broken down into FRACTIONS or DECIMALS

3) The random variable x represents the number of cars per household in a town of 1000 households. Find the probability of randomly selecting a household that has less than two cars. $x<2$, so $x=0$ or $x=1$ → ADD

Cars	Households
0	125
1	428
2	256
3	108
4	83

553

1000 Total

$P(x<2)=P(0)+P(1)$

$=\frac{125}{1000}+\frac{428}{1000}=\frac{553}{1000}=\boxed{.553}$

4) A student has five motor vehicle accidents in one year and claims that having five accidents is not unusual. Use the frequency distribution below to determine if the student is correct.

Accidents	0	1	2	3	4	5
Students	260	500	425	305	175	45

Total: 1710

$P(x=5)=\frac{45}{1710}=0.026=2.6\%<5\%$

$\boxed{0.026<0.05}$

The student is incorrect: the probability is very small, so it is unusual.

5) A sports analyst records the winners of NASCAR Winston Cup races for a recent season. The random variable x represents the races won by a driver in one season. Use the frequency distribution to construct a probability distribution. → table

x: Wins	1	2	3	4	5	6	7
Drivers	12	2	0	2	0	0	1
P(x)	12/17	2/17					1/17
	.71	.12	0	.12	0	0	.05

⇒ Total: 17

$\Sigma P(x)=1$ ✓

6) Determine the probability distribution's missing value.
The probability that a tutor will see 0, 1, 2, 3, or 4 students

x	0	1	2	3	4
P(x)	$\frac{4}{27}$	$\frac{1}{27}$	$\frac{5}{9}$	?	$\frac{5}{27}$

Need $\boxed{\Sigma P(x) = 1} \leftarrow \frac{27}{27}$

So missing: $\boxed{\frac{2}{27}}$

$$\frac{4}{27} + \frac{1}{27} + \frac{5 \cdot 3}{9 \cdot 3} + \frac{5}{27} = \frac{25}{27}$$

7) Determine the probability distribution's missing value.
The probability that a tutor will see 0, 1, 2, 3, or 4 students

x	0	1	2	3	4
P(x)	0.01	0.04	0.37	0.34	?

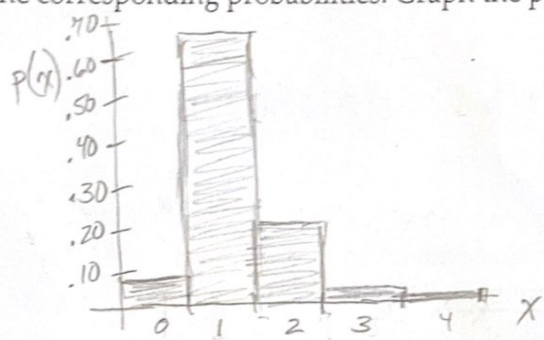
Need $\boxed{\Sigma P(x) = 1}$

Total so far: 0.76

$1 - .76 = \boxed{0.24}$ Missing value

8) The random variable x represents the number of credit cards that adults have along with the corresponding probabilities. Graph the probability distribution.

x	P(x)
0	0.07
1	0.68
2	0.21
3	0.03
4	0.01



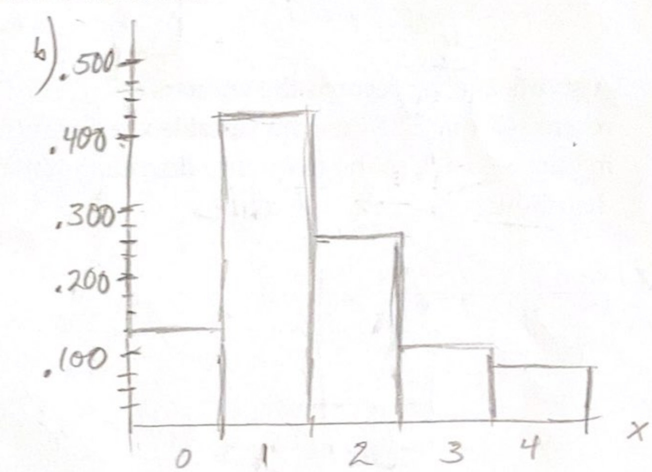
9) Use the frequency distribution to (a) construct a probability distribution → table for the random variable x represents the number of cars per household in a town of 1000 households, and (b) graph the distribution.

a)

Cars (x)	Households	P(x)
0	125	.125 ← $\frac{125}{1000}$
1	428	.428
2	256	.256
3	108	.108
4	83	.083

Total: 1000 $\Sigma P(x) = 1.000$ ✓

b)



5.1 Two conditions of discrete probability distributions:

10) Determine whether the distribution represents a probability distribution. If not, identify any requirements that are not satisfied.

x	P(x)
1	0.2
2	0.2
3	0.2
4	0.2
5	0.2
	1.0 Sum

- Each prob. is between 0 & 1? Yes ✓
- $\Sigma P(x) = 1$? Yes ✓

11) Determine whether the distribution represents a probability distribution. If not, identify any requirements that are not satisfied.

x	P(x)
1	−0.2
2	−0.2
3	−0.2
4	−0.2
5	−0.2

- Each prob is between 0 & 1? No ✗

Not a prob. distr. since probabilities cannot be neg.

12) The random variable $\boxed{\text{x represents the number of boys}}$ in a family of three children. Assuming that boys and girls are equally likely, find the mean and standard deviation for the random variable x.

BINOMIAL 5.2 4 conditions
1) Fixed # of independent trials $\Rightarrow n = 3$
2) Two outcomes: boy/girl $\Rightarrow$ X is # of $\boxed{\text{boys}}$
3) Consistent probability $\Rightarrow p = 0.5$
4) X counts successes: $\Rightarrow X = \{0, 1, 2, 3\}$

mean $= \mu = n \cdot p = 3(.5) = 1.5$

stand. dev. $= \sigma = \sqrt{npq} = \sqrt{3(.5)(.5)} = .87$

13) The random variable x represents the number of credit cards that adults have along with the corresponding probabilities. Find the mean and standard deviation.

$\mu = \Sigma\, x \cdot P(x)$ = expected value

Stat edit

x (L1)	P(x) (L2)	$x \cdot P(x)$
0	0.07	0
1	0.68	0.68
2	0.21	0.42
3	0.03	0.09
4	0.01	0.04

$\mu = \boxed{1.23}$

Easier:
STAT edit
STAT calc → 1-Var Stats L1, L2, enter

$\Rightarrow$ $\bar{X} = 1.23$, $\sigma_x = 0.661$

14) One thousand tickets are sold at \$1 each. One ticket will be randomly selected and the winner will receive a color television valued at \$398. What is the expected value for a person that buys one ticket?

−\$1 ticket

	Gain	Prob.	$x \cdot P(x)$
Win	397 ×	$\frac{1}{1000}$ =	$\frac{397}{100}$
Lose	−1 ×	$\frac{999}{1000}$ =	$\frac{-999}{1000}$

$$E(x) = \Sigma(x \cdot P(x)) = \frac{397}{1000} + \frac{-999}{1000} = \frac{-602}{1000} = \boxed{-.60}$$

15) From the probability distribution, find the mean and standard deviation for the random variable x, which represents the number of cars per household in a town of 1000 households.

$\mu = 1.596$

$\sigma \approx 1.098$

L1 L2 ← probability distribution

x	P(x)
0	0.125
1	0.428
2	0.256
3	0.108
4	0.083

STAT edit

STAT calc

→ 1-var Stats

L1

L2

$\boxed{5.1}$

16) Decide whether the experiment is a binomial experiment. If it is not, explain why. You observe the gender of the next 150 babies born at a local hospital. The random variable represents the number of girls. $= x$

$n = 150$

$\boxed{5.2}$ ↓

#1) fixed # of trials ✓

2) Two possible outcomes ✓ (boy or girl)

3) $P(S) = P(\text{girl}) = .5$ ✓

4) x counts successes ✓

$\boxed{\text{Yes}}$

17) Decide whether the experiment is a binomial experiment. If it is not, explain why. You roll a die 750 times. The random variable represents the number that appears on each roll of the die.

$\boxed{\text{No}}$

X 4) x counts # of successes

X 2) Two possible outcomes

18) Decide whether the experiment is a binomial experiment. If it is not, explain why. Surveying 1000 prisoners to see whether they are serving time for their first offense. The random variable represents the number of prisoners serving time for their first offense.

$n = 1000$

$\boxed{\text{Yes}}$

✓ fixed # of trials

✓ Two possible outcomes

✓ Same prob. success

✓ x counts successes

19) Decide whether the experiment is a binomial experiment. If it is not, explain why. Each week, a man plays a game in which he has a 36% chance of winning. The random variable is the number of times he wins in 78 weeks. → $n = 78$

$P(S) = .36$

$\boxed{\text{Yes}}$

✓ Fixed # of trials

✓ Win or lose

✓ $P(S) = .36$

✓ x counts wins

20) Assume that male and female births are equally likely and that the birth of any child does not affect the probability of the gender of any other children. Suppose that 650 couples each have a baby; find the mean and standard deviation for the number of girls in the 650 babies.

$p = P(S) = .5$ & $q = P(F) = .5$

$n = 650$

$\mu = n \cdot p$

$\mu = 650(.5)$

$\boxed{\mu = 325}$

$\sigma = \sqrt{n \cdot p \cdot q}$

$= \sqrt{650(.5)(.5)}$

$\approx \boxed{12.75}$

21) A test consists of 330 true or false questions. If the student guesses on each question, what is the mean number of correct answers?

$n = 330$

$p = .5$

$\mu = n \cdot p$

$\mu = 330(.5) = \boxed{165}$

22) In a recent survey, 80% of the community favored building a police substation in their neighborhood. If 15 citizens are chosen, what is the mean number favoring the substation?

$p = .80$

$n = 15$

$\mu = n \cdot p$

$\mu = 15(.8) = \boxed{12}$

23) According to police sources, a car with a certain protection system will be recovered 92% of the time. If 900 stolen cars are randomly selected, what is the mean and standard deviation of the number of cars recovered after being stolen?

$p = .92$, $n = 900$

$q = 1 - .92$

$q = .08$

$\mu = n \cdot p$

$\mu = 900(.92)$

$\boxed{\mu = 828}$

$\sigma = \sqrt{n \cdot p \cdot q}$

$\sigma = \sqrt{900(.92)(.08)}$

$\boxed{\sigma = 8.14}$

24) Assume that male and female births are equally likely and that the birth of any child does not affect the probability of the gender of any other children. Find the probability of exactly eight boys in ten births.

$p = .5$ 0.0439

$n = 10$

$P(x=8) = \frac{10!}{(10-8)!\,8!}(.5)^8(.5)^2$ OR ${}_{10}C_8(.5)^8(.5)^2$ OR $\boxed{\text{binompdf}(10, .5, 8)}$

25) A test consists of 10 multiple choice questions, each with five possible answers, one of which is correct. To pass the test a student must get 60% or better on the test. If a student randomly guesses, what is the probability that the student will pass the test? Let x = # correct

$\boxed{n=10}$

$\Rightarrow \boxed{p = \frac{1}{5} = .20}$

6 correct $\left(\frac{6}{10}\right)$

$P(x \geq 6) = P(6) + P(7) + P(8) + P(9) + P(10)$, could use $\boxed{\text{binompdf}}$ for each

OR $1 - P(x \leq 5)$, use binomcdf(10, .2, 5)

$= 1 - 0.9936 = \boxed{0.0064}$

$p=.70,\ q=.30$

26) A recent survey found that 70% of all adults over 50 wear glasses for driving. In a random sample of 10 adults over 50, what is the probability that at least six wear glasses? $X=6$ or 7 or 8 or 9 or 10 $n=10$ $p=.70$

$$P(x\geq 6)=P(6)+P(7)+P(8)+P(9)+P(10)$$

OR $1-P(X\leq 5)\Rightarrow$ binomcdf$(10,.7,5)=\boxed{0.8497}$

27) Fifty percent of the people that get mail-order catalogs order something. Find the probability that exactly six of 10 people getting these catalogs will order something. $p=.5,\ q=.5$ $n=10$

$$P(x=6)={}_{10}C_6\,(.5)^6(.5)^4 = 0.2051$$

binompdf$(10,.5,6)=\boxed{0.2051}$

28) Sixty-five percent of men consider themselves knowledgeable football fans. If 12 men are randomly selected, find the probability that exactly two of them will consider themselves knowledgeable fans. $p=.65,\ n=12$ $X=2$

$$P(2)={}_{12}C_2\,(.65)^2(.35)^{10}$$

binompdf$(12,.65,2)=7.69\times10^{-4}=\boxed{.000769}$

.0008

29) You observe the gender of the next 100 babies born at a local hospital. You count the number of girls born. Identify the values of n, p, and q, and list the possible values of the random variable x. $X=0,1,2,\ldots 100$ $n=100$ $p=.5,\ q=.5$

30) Fifty-seven percent of families say that their children have an influence on their vacation plans. Consider a sample of eight families who are asked if their children influence their vacation plans. Identify the values of n, p, and q, and list the possible values of the random variable x. $X=0,1,2,\ldots 8$ $p=.57,\ q=.43$ $n=8$