

Statistics 23, Section 1, Midterm I
 Tuesday, September 21, 1999

Name: _____

Pledge: I have neither given nor received aid on this examination.

Signature: _____

Instructions: Show all work, but do not do hard arithmetic (an answer of the form $\binom{8}{3} \cdot 3^7$ is fine).

1. A company makes 50% of its cars at Factory A, 30% at Factory B and the rest at Factory C. Factory A produces 10% lemons, Factory B produces 15% lemons, and Factory C produces 20% lemons. If a car is randomly selected for the overall production system,
 - a. What is the probability that it is a lemon?

- b. If it turns out to be a lemon, then what is the probability that it was built at Factory C?

2. The IRS says about 5 in 1000 tax returns with income below \$50,000 are audited, as are 10 in 1000 for income between \$50,000 and \$99,999, and 25 in 1000 for income \$100,000 and more.

(a) If 10 taxpayers are chosen at random from the high income group, write a (complete) formula that could be used in an Excel formula bar to calculate the probability that:

(i) Either none, or else at least 4 of them get audited.

(ii) Exactly 2 of them gets audited, if it is known that at least 2 are audited.

(b) Fill out the Excel menu below to calculate the probability that from a group of 15 taxpayers chosen randomly from the low income group, exactly one of them gets audited.

BINOMDIST			
Number_s	<input type="text"/>		= number
Trials	<input type="text"/>		= number
Probability_s	<input type="text"/>		= number
Cumulative	<input type="text"/>		= logical
=			
Returns the individual term binomial distribution probability.			
Number_s is the number of successes in trials.			
	Formula result =	<input type="button" value="OK"/>	<input type="button" value="Cancel"/>

(c) If three taxpayers are randomly selected from the low income groups, and four are selected from the high income group, write a complete Excel formula to calculate the probability that none of these will be audited.

3. Suppose events A , B and C all have probability 0.6, and A and B are mutually exclusive, and B and C are independent.

a. Find $P\{A \text{ or } B\}$.

b. Find $P\{B \text{ or } C\}$.

4. The random variable X has distribution:

x	0	1	2	4
$f(x)$	0.3	0.2	0.1	0.4

a. Find $P\{1 \leq X < 4\}$.

b. Find $P\{X = 4 \mid X \geq 2\}$.

c. Find $P\{X = 4 \mid X \leq 2\}$.

5 The following table shows the numbers of adults from a small town in age income categories, entered into an Excel spreadsheet, for marketing research purposes.

		E6 = =SUM(B6:D6)					
	A	B	C	D	E	F	
1			Income				
2	Age	<\$20K	\$20K-50K	>\$50K	Totals		
3	<25	5793	3689	2594	12076		
4	25-45	2309	4712	3695	10716		
5	>45	249	938	1219	2406		
6	Totals	8351	9339	7508	25198		
7							

Consider the following events, for a randomly chosen person:

- A: {Person is 25 or over }
- B: {Person is 45 or under }
- C: {Person has income between \$20K and \$50K }
- D: {Person has at least \$20K income }

a. Write (complete) Excel formulas that could be entered into a formula bar to calculate:

i. $P\{A \text{ and } B\}$.

ii. $P\{A | B\}$.

iii. $P\{D | A\}$.

iv. $P\{A \text{ or } B\}$.

- c. One way of finding $P\{A \text{ or } C\}$, is by a sum of table values, divided by the total. Fill out this menu, to calculate the sum needed in the numerator.

- c. Another way to find $P\{A \text{ or } C\}$, is via the “or” rule for probabilities. Write an Excel formula for solving the problem this way.

- d. Describe how you would check whether the events A and D are independent or not.

- e. Are the events A and B mutually exclusive? Why or why not?