Devry College of Technology Fall 2003 - Winter 2004

Math 221: Basic Statistics Quiz #4A

Week #8

Name:________________________

SHOW ALL YOUR WORK FOR FULL CREDIT!

Statistics reported by the Air Transport Association indicate that there were approximately 9 million airline flights and a total of 3 fatal accidents during the year 2000.

(1) If one flight is selected at random during the year 2000, what is the probability that it involved a fatal accident?

(2) Suppose that the probability of a fatal accident in a given year is 0.0000003. A binomial probability distribution for $n = 9,000,000$ and $p = 0.0000003$, what is the probability that there will be

(a) exactly 3 accidents?

(b) at least one accident?

Devry College of Technology Fall 2003 - Winter 2004

Math 221: Basic Statistics Quiz #4B

Week #8

Name:________________________

SHOW ALL YOUR WORK FOR FULL CREDIT!

Statistics reported by the Air Transport Association indicate that there were approximately 8.3 million airline flights and a total of 1 fatal accidents during the year 1998.

(1) If one flight is selected at random during the year 1998, what is the probability that it involved a fatal accident?

(2) Suppose that the probability of a fatal accident in a given year is 0.0000001. A binomial probability distribution for $n = 10,000,000$ and $p = 0.0000001$, what is the probability that there will be

(a) exactly 2 accidents?

(b) at least one accident?

Devry College of Technology Fall 2003 - Winter 2004

Math 221: Basic Statistics Quiz #4C

Week #8

Name:________________________

SHOW ALL YOUR WORK FOR FULL CREDIT!

Statistics reported by the Air Transport Association indicate that there were approximately 8.2 million airline flights and a total of 3 fatal accidents during the year 1997.

(1) If one flight is selected at random during the year 1997, what is the probability that it involved a fatal accident?

(2) Suppose that the probability of a fatal accident in a given year is 0.0000004. A binomial probability distribution for $n = 7,000,000$ and $p = 0.0000004$, what is the probability that there will be

(a) exactly 4 accidents?

(b) at least one accident?

Math 221: Basic Statistics Quiz #4 Solutions

Week #9

(1) To find the probability, simply divide the number of fatal accidents by the approximate number of flights. This gives

$p \approx \frac{3}{9 \times 10^6} \approx 3.3333 \times 10^{-7}.$	$p \approx \frac{1}{8.3 \times 10^6} \approx 1.2048 \times 10^{-7}.$	$p \approx \frac{3}{8.2 \times 10^6} \approx 3.6585 \times 10^{-7}.$

(2) In this part you are given p and n and asked to compute binomial probabilities

(a) To find the basic binomial probability, use the formula

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

$n = 9 \cdot 10^6$	$n = 10 \cdot 10^6$	$n = 7 \cdot 10^6$
$p = 3 \cdot 10^{-7}$	$p = 1 \cdot 10^{-7}$	$p = 4 \cdot 10^{-7}$
$P(X = 3)$	$P(X = 2)$	$P(X = 4)$
$= \binom{n}{3} p^3 (1-p)^{n-k}$	$= \binom{n}{2} p^2 (1-p)^{n-k}$	$= \binom{n}{4} p^4 (1-p)^{n-k}$
$= \binom{9 \cdot 10^6}{3} (3 \cdot 10^{-7})^3$	$= \binom{10 \cdot 10^6}{2} (1 \cdot 10^{-7})^2$	$= \binom{7 \cdot 10^6}{4} (4 \cdot 10^{-7})^4$
$\times\ (.9999997)^{8,999,997}$	$\times\ (.9999999)^{9,999,998}$	$\times\ (.9999996)^{6,999,996}$
$= 0.22047$	$= 0.18394$	$= 0.15574$

(b) To solve the last part, you must realize that the opposite of "at least one accident" is "no accidents" or

$$P(X \geq 1) = 1 - P(X = 0) = 1 - \binom{n}{0} p^0 (1-p)^n = 1 - (1-p)^n.$$

This gives

$P(X \geq 1)$	$P(X \geq 1)$	$P(X \geq 1)$
$= 1 - (1-p)^n$	$= 1 - (1-p)^n$	$= 1 - (1-p)^n$
$= 1 - (.9999997)^{9 \cdot 10^6}$	$= 1 - (.9999999)^{10 \cdot 10^6}$	$= 1 - (.9999996)^{7 \cdot 10^6}$
$= 1 - 0.06721$	$= 1 - 0.36788$	$= 1 - 0.06081$
$= 0.93279$	$= 0.63212$	$= 0.93919$