The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high net worth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q1: If a random 100 such tax returns are audited what is the probability that exactly 5 fraudulent returns will be uncovered?

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q1: If a random 100 such tax returns are audited what is the probability that exactly 5 fraudulent returns will be uncovered?

Ans1: n = 100, p = 0.05

P(Fraud = 5) = BINOM.DIST(5, 100, 0.05, FALSE)

= 0.1800

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q2: If a random 250 high net worth tax returns are audited, what is the probability that the IRS will uncover at least 15 fraudulent returns?

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q2: If a random 250 high net worth tax returns are audited, what is the probability that the IRS will uncover at least 15 fraudulent returns?

Ans2: n = 250, p = 0.05

$$P(\text{Fraud} \geq 15) = 1 - P(\text{Fraud} \leq 14)$$

$$= 1 - \text{BINOM.DIST}(14, 250, 0.05, \text{TRUE})$$

$$= 0.2712$$

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q3: If a random 250 high net worth tax returns are audited, what is the probability that the IRS will uncover at least 15 fraudulent returns but at most 20 fraudulent returns?

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q3: If a random 250 high net worth tax returns are audited, what is the probability that the IRS will uncover at least 15 fraudulent returns but at most 20 fraudulent returns?

Ans3: n = 250, p = 0.05

$$P(15 \le Fraud \le 20) = P(Fraud \le 20) - P(Fraud \le 14)$$

$$= BINOM.DIST(20, 250, 0.05, TRUE) - BINOM.DIST(14, 250, 0.05, TRUE)$$

$$= 0.2563$$

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q4: What is the probability that out of the 250 randomly selected high net worth tax returns no fraudulent return is uncovered?

The Binomial Distribution

In the current tax year, IRS estimates that 5% of the many high networth individual tax returns would be fraudulent. That is they will contain errors that are purposely made to cheat the government. Although these errors are often well concealed, let's suppose that a thorough IRS audit will uncover them.

Q4: What is the probability that out of the 250 randomly selected high net worth tax returns no fraudulent return is uncovered?

Ans4: n = 250, p = 0.05

P(Fraud = 0) = BINOM.DIST(0, 250, 0.05, FALSE)

= 2.69×10^{-6} (a very small number)

The Binomial Distribution

=BINOM.DIST(x, n, p, FALSE/TRUE)

The Binomial Distribution

=BINOM.DIST(x, n, p, FALSE/TRUE)

Mean of the Binomial Distribution = $n \times p = np$

Standard Deviation of the Binomial Distribution = $\sqrt{np(1-p)}$

The Binomial Distribution

=BINOM.DIST(x, n, p, FALSE/TRUE)

Mean of the Binomial Distribution = $n \times p = np$

Standard Deviation of the Binomial Distribution = $\sqrt{np(1-p)}$

In our IRS example…

Mean number of fraudulent returns likely to be uncovered when IRS randomly audits 250 high net worth returns?

= np = 250×0.05 = **12.5 returns**