BINOMIAL PROBABILITY AND HYPOTHESIS TESTING.

1a) $X = 5$ $N = 15$ $p = 0.35$

$P(X = 5) = \underline{0.212}$ (3sf)

b/ $X = 3$ $N = 15$ $p = 0.35$ (cumulative)

$P(X < 4) = \underline{0.173}$ (3sf)

c/ $X = 10$ $N = 15$ $p = 0.35$ (cumulative)

$P(X \leq 10) = \underline{0.997}$ (3sf)

2a/ $X = 1$ $N = 30$ $P = 0.1$

$P(X = 1) = \underline{0.141}$ (3sf)

b/ probability of more than 4 $= 1 - P(4 \text{ or less})$

$X = 4$ $N = 30$ $P = 0.1$ (CD)

$1 - 0.8245 = \underline{0.175}$ (3sf)

c/ $X = 2$ $N = 30$ $P = 0.1$ (CD)

$\underline{0.411}$ (3sf)

3a/ $X = 7$ $N = 20$ $P = 0.41$ $X = 3$ $N = 20$ $P = 0.41$
     $P(X \leq 7) = 0.38044...$ $P(X \leq 3) = 0.01278...$

$0.38044 - 0.01278 = \underline{0.368}$ (3sf)

3b/

$$H_0: \quad p = 0.3$$
$$H_1: \quad p < 0.3$$

$n = 40 \qquad 5\% \text{ sig level}$

$$P(x \leq 7) = 0.0553$$

$0.0553 > 5\% \qquad \therefore$ there is not enough evidence to support H1

Not enough evidence that prop. has decreased.

c/ $\quad 0.0553 < 10\% \qquad \therefore$ there is evidence to support H1

The prop. has decreased.

4a/ $\quad P(x \geq 12) = 1 - P(x \leq 11)$

$x = 11 \qquad N = 30 \qquad P = 0.58 \qquad CD.$

$$P(x \leq 11) = 0.0151 \quad (3sf)$$

$$P(x \geq 12) = 1 - 0.0151$$
$$= 0.985 \quad (3sf)$$

b/ $\quad H_0: \quad p = 0.3$
$\quad H_1: \quad p > 0.3$

$n = 40 \qquad 1\% \text{ sig level}$

$$P(x \geq 19) = 1 - P(x \leq 18)$$
$$= 1 - 0.9852$$
$$= 0.0148$$

$0.0148 > 1\% \qquad$ there is evidence to support H1

prop ordering coffee not incr.

c/ $\quad 0.0148 < 5\% \qquad$ there is not enough evidence to support H1

prop. ordering coffee has incr.

5a) $P(X \geqslant 2) = 1 - P(x \leqslant 1)$

$x = 1 \quad N = 15 \quad P = 0.08$

$P(x \geqslant 2) = 1 - 0.65972...$
$= 0.340 \; (3sf)$

b) $H_0 : \rho = 0.08$
$H_1 : \rho > 0.08$
$n = 20 \qquad 5\% \text{ sig. level}$

$P(X \geqslant 3) = 1 - P(x \leqslant 2)$
$= 1 - 0.7879...$
$= 0.212 \; (3sf)$

$0.212 > 5\% \qquad \therefore \quad$ there is not enough evidence to support H1
Not enough evidence to say probability is more than 0.08.

6a) i/ $X = 15$ $N = 20$ $P = 0.6$ PD

$P(X = 15) = 0.0746$ (3sf)

ii/ $P(X > 15) = 1 - P(X \leq 15)$

$X = 15$ $N = 20$ $P = 0.6$ CD

$1 - 0.949...$

~~0.0501~~ (3sf)

0.0510

b/ $H_0 : P = 0.6$
          $H_1 : P \neq 0.6$

10% Sig level   Two tail [5% each side]
$N = 50$

$P(X \geq 35) = 1 - P(X \leq 34)$
            $= 1 - 0.904498...$
            $= 0.095501...$

$0.0955 > 5\%$ there is not enough evidence to support H1

There is not enough evidence to suggest the prob. has changed

7a) $X = 5$ $N = 20$ $P = 0.4$

$P(X = 5) = 0.0746$

b/ $H_0: p = 0.4$
     $H_1: p \neq 0.4$

c/ $X \leq 3$ chance of rejection 0.0160
     $X \geq 13$ chance of rejection $1 - 0.9790$
                                          $= 0.0210$

d/ $0.016 + 0.021 = 0.037$ (3.7%)

e/   There is not enough evidence to say the prob.
     is not 0.4.
     there is not enough evidence to support H1