Question 1 (Ex5.1, P383)

(a) X is Binomial distribution if we assume no identical twins or multiple births (this would violate independence) and that the probability of female is the same for all births.

(b) No, this is not a Binomial distribution because it is not a fixed number of trials.

(c) No, X here is not a Binomial distribution, because opinions of husband and wife are not necessarily independent.

Question 2 (Ex5.9, P386)

a) (a) Let X = no. of 0s in a group of digits. Then X ~ B(5, 0.1). P(X ≥ 1) = 1- P(X=0) =1 – 0.5905 = o.4095 by Table C.

b) (b) Let X = no. of 0s in the line 40 digits long, then X ~ B(40, 0.1) By mean formula for a Binomial distribution, the mean number of 0s is $40 \times 0.1 = 4$.

Question 3 (Ex5.11, P386)

(a) Let X = McGwire's home run count, then X ~ B(509, 0.116).
$\mu_X = np = 509 \times 0.116 = 59.044$. So the mean number of home runs McGwire will hit in 509 times at bat is about 59.

(b) $\sigma_X = \sqrt{np(1-p)} = \sqrt{509 \times 0.116 \times 0.884} = 7.2246$. We use Normal approximation to calculate P(X ≥ 70):
$P(X \geq 70) = P(\frac{X - 59.044}{7.2246} \geq \frac{70 - 59.044}{7.2246}) = P(Z \geq 1.516) = 0.065$. So about 6.5% chance of more than 70 home runs. If you use the continuity correction, Z=1.447 and the probability is a bit higher.

(c) Let Y = Barry Bonds' home run count, then Y ~ B(476, 0.0865).
$\mu_Y = np = 476 \times 0.0865 = 41.174$
$\sigma_Y = \sqrt{np(1-p)} = \sqrt{476 \times 0.0865 \times 0.9135} = 6.1329$
We use normal approximation to calculate P(Y ≥ 73) = P(Z ≥ (73-41.174)/6.1329) =P(Z ≥ 5.1894)=0.

Question 4 (Ex5.20, P389)

(a) First, for each observation, the driver is either a male or a female: just two possible outcomes. Second, the cars should be independent and the probability of a male driver should be the same for each car. Therefore, by the definition of Binomial distribution, if we let X be number of male drivers for n cars, X is Binomial distribution.

(b) There might be different probabilities of a male driving in the two situations.

(c) Let X be the number of male drivers of the 10 cars, then X ~ B(10, 0.85). Using table C, we could get: P(X ≤ 8) = 0.4557.

(d) Let Y be the number of male drivers of 100 cars, then Y ~ B(100, 0.85). Using Normal approximation for calculation:

$\mu_Y = np = 100 \times 0.85 = 85$

$\sigma_Y = \sqrt{np(1-p)} = \sqrt{100 \times 0.85 \times 0.15} = 3.5707$

Y ~ N(85, 3.5707) approximately.

P(Y≤ 80) ≈ P(Y ≤ 80.5) =P(Z ≤ (80.5-85)/3.5707) = P(Z ≤ -1.26) = 1.1038.