1.

X = # of daily requests for assistance.

i) $P(X \geq 4) = 0.12 + 0.10 + 0.08 + 0.07 + 0.06 + 0.04 + 0.03$

$= 0.50$

or $P(x \geq 4) = 1 - P(X \leq 3)$

$= 1 - (0.06 + 0.14 + 0.16 + 0.14)$

$= 0.50$

ii) $P(4 \leq X \leq 6) = 0.12 + 0.10 + 0.08 = 0.30$

(iii) Mean number of requests $\mu = \sum_{x=0}^{10} x\,p(x)$

$= 3.97$ requests.

σ^2 = variance of number of requests

$= \sum x^2 p(x) - \mu^2$

$= 22.85 - 15.76$

$= 5.11$

$\Rightarrow$ Standard deviation of number of requests $= \sqrt{5.11} = 2.26$ (requests)

(iv) P(city ask for assistance) $= P(X > 3.97)$

$= P(X \geq 4)$

$= 0.50$

2. X = # of automobiles with high emissions

(i) $P(X=10) = (0.6)^{10}$

(ii) $P(X=6) = \binom{10}{6}(0.6)^6(0.4)^4$

(iii) $P(X \geq 6) = \sum_{x=6}^{10} \binom{10}{x}(0.6)^x(0.4)^{10-x}$

(iv) $P(X \leq 3) = \sum_{x=0}^{3} \binom{10}{x}(0.6)^x(0.4)^{10-x}$

(v) Assumptions : (i) each automobile has probability 0.6 of having high emissions

(ii) The automobiles are independent of one another in terms of having high emissions

(i) & (ii) $\Longrightarrow X \sim B(10, 0.6)$.

3. This is an example of the geometric random variable.
X = # of trials until the 1st gear wheel fails.

$P(X=5) = (0.9)^4(0.1)$

4. A lot has 40 widgets; 6 of which are defective.
A sample of size $n = 5$ is chosen.
$X = \#$ of defective widgets in the sample.

$$P(X \geq 2) = 1 - P(X \leq 1)$$

$$= 1 - \left[P(X=0) + P(X=1) \right]$$

$$= 1 - \left[\frac{\binom{34}{5}}{\binom{40}{5}} + \frac{\binom{6}{1}\binom{34}{4}}{\binom{40}{5}} \right].$$

5. $X = \#$ of defective fuses in a sample of 6.

$X \sim B(6, 0.08)$

$$P(X < 2) = P(X \leq 1) = \sum_{x=0}^{1} \binom{6}{x} (0.08)^x (0.92)^{6-x}$$

6. If the selection is random, then

$$P(\text{3 females are chosen}) = \frac{\binom{3}{3}\binom{7}{1}}{\binom{10}{4}} = 0.033$$

which is very low.

Thus it is hard to believe that the personnel director's claim. He/she is probably biased.

7. Rate of accidents $\alpha = 0.3/hr.$

X = # of accidents.

$P(X >$

$$P(X > 4) = \sum_{x=5}^{\infty} \frac{e^{-(0.3)(10)} (3)^x}{x!}$$

$$= 1 - \sum_{x=0}^{4} \frac{e^{-3}\, 3^x}{x!}$$