3.7 Given pmf is

x	0	1	2
$p(x)$	0.4	0.4	0.2

Given, the team plays 2 games.

Y = total number of home runs.

$E(Y_1)$ and $E(Y_2)$ are the two Expectations for Each game.

$$E(Y_1) = 0\times 0.4 + 1\times 0.4 + 2\times 0.2$$
$$= 0.4 + 0.4 = 0.8.$$

Similarly $E(Y_2) = 0.8$

$$E(Y) = E(Y_1) + E(Y_2)$$
$$= 0.8 + 0.8.$$

$$\boxed{E(Y) = 1.6}$$

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

$$x^2 p(x) = 0\times 0.4 + 1\times 0.4 + 4\times 0.2$$
$$= 0 + 0.4 + 0.8 \Rightarrow 1.2$$

$$Var(Y_1) = 1.2 - (0.8)^2$$
$$= 1.2 - 0.64 \Rightarrow 0.56.$$

Similarly $Var(Y_2) = 0.56.$

$$Var(Y) = Var(Y_1) + Var(Y_2)$$
$$= 0.56 + 0.56$$

$$\boxed{Var(Y) = 1.12}$$

3.21 Given, $N = 20$

$p = 0.4$.

$P(x \geq 10) = 1 - P(X \leq 9)$

$= 1 - F(9)$

As per the Binomial distribution table,

for $N = 20$, $p = 0.4$

$F(9) = 0.755$.

$P(x \geq 10) = 1 - 0.755$

$= \boxed{0.245}$

3.22 Given, five percent of computer parts produced by a certain supplier are defective.

So $p = \frac{5}{100} = 0.05$

No. of Sample parts $(n) = 16$.

$p(X > 3) = 1 - p(X < 3)$

As per the Binomial Distribution table,

for $p = 0.05$, $n = 16$, $x = 3$, the probability value of X is 0.993.

$p(X > 3) = 1 - 0.993$

$= \boxed{0.0070}$

3.31 Given, $p = \frac{80}{100}$

$= 4/5$

$q = 1 - p \Rightarrow 1 - \frac{4}{5}$

$= 1/5$.

$P(X \geq 18)$ where X is Binomial Distribution

$\boxed{(n = 20, p = 0.8)}$

$$P(X=x) = \binom{20}{x}(0.8)^{x}(0.2)^{20-x}$$

(a) $P(X \geq 18) = P(x=18) + P(x=19) + P(x=20)$.

$$= \binom{20}{18}(0.8)^{18}(0.2)^{2} + \binom{20}{19}(0.8)^{19}(0.2)^{1} + \binom{20}{20}(0.8)^{20}(0.2)^{0}$$

$$= 0.1369 + 0.0576 + 0.0115$$

$$P(X \geq 18) = \boxed{0.2061}$$

b) Let X be the number of components that is to be inspected untill a component passes an inspection.

$$P(X=x) = (1-p)^{x} \cdot p \quad (\text{Geometric Distribution})$$

$$E(X) = 1/p.$$

$$\text{Avg. no of components} = \frac{1}{p} = \frac{1}{\frac{8}{10}} = \frac{10}{8}$$

$$= \boxed{1.25.}$$

3.36 Given, $n=10$

$p = 0.7$

$P(X=6) = P(X \le 6) - P(X \le 5)$

$= F(6) - F(5)$

As per the Binomial distribution table,

for $n=10$, $p=0.7$, $F(6) = 0.350$

$F(5) = 0.150$.

$P(X=6) = 0.350 - 0.150$

$= \boxed{0.200}$

Hyper Geometric Distribution problem

Sol :- Given, $N = 15$

$M = 6$

$n = 3$

$$P.M.F \text{ of } X = \frac{\binom{M}{x}\binom{N-M}{n-x}}{\binom{N}{n}}$$

M is the defectives

N is the total Sample.

n is the sample that we consider.

The traveller will be arrested, if he possesses atleast one narcotic tablet out of three selected.

$$p(X \geq 1) = 1 - p(X = 0)$$

$$= 1 - \frac{6c_0 \cdot 9c_3}{15c_3}$$

$$= \boxed{0.8154}$$

4.17 All the values are taken from Standard Normal Distribution table.

(a) $p(Z \geq 0.99) = 1 - F(0.99)$

$= 1 - 0.8389$

$= \boxed{0.1611}$

(b) $p(Z \leq -0.99) = \Phi(-0.99)$

$= \boxed{0.1611}$

(c) $p(Z < 0.99) = \Phi(0.99) = \boxed{0.8389}$

~~(d) P(|Z| ... 1.25) =~~

(d) $p(|Z| > 0.99) = p(Z < -0.99) + p(Z > 0.$

$= 2(0.1611) = \boxed{0.3222}$

(e) $P(z<10)$

The value $z=10$ is outside the normal distribution Table, so take $z=3.99$

$$P(z<10)=\Phi(3.99)$$
$$=\boxed{1.0}$$

(f) $P(z>10)=1-P(z<10)$
$$=1-\Phi(3.99)$$
$$=1-1$$
$$=\boxed{0.0}$$

(g) $\Phi(z)=0.9$

from the normal distribution table,

$\Phi(z)$ should be close to 0.9

$\Phi(1.28)=0.8997 \cong 0.9$.

Therefore $z=\boxed{1.28}$

4.21

Given, Average height = 6 feet 7 inches
$$=(6\times12)+7$$
$$=79 \text{ inches}$$

so $\mu=79$.

$\sigma=3.89$

(a) $P(X > 84)$.

$$z = \frac{x-\mu}{\sigma} = \frac{84-79}{3.89} = 1.29.$$

$$P(z > 1.29) = 1 - \Phi(1.29)$$
$$= 1 - 0.9015$$
$$= 0.0985$$
$$= \boxed{9.85\%}$$

(b) Given

$$P(X > x) = 0.20.$$

$$z = \frac{x-\mu}{\sigma} = \frac{x-79}{3.89}$$

$$P\left(z > \frac{x-79}{3.89}\right) = 1 - \Phi\left(\frac{x-79}{3.89}\right) = 0.20.$$

$$\Phi\left(\frac{x-79}{3.89}\right) = 0.80$$

from the table $\Phi(0.84) = 0.7995 \simeq 0.8$.

So $\frac{x-79}{3.89} = 0.84$.

$$\Rightarrow x = (0.84 \times 3.89) + 79$$

$$\Rightarrow x = \boxed{82.3 \text{ inches}}$$ or 6ft 10.3 inches

4-22

Given $\mu = 900$, $\sigma = 200$

(a) $P(X < 640)$

$$z = \frac{x - \mu}{\sigma} \text{ and } 900 \div$$

$$z = \frac{640 - 900}{200} = -1.3$$

$$P(z < -1.3) = 0.0968$$

$$= \boxed{9.68\%}$$

(b) $P(X < x) = 0.05$

$$z = \frac{x - 900}{200}$$

$$P\left(Z < \frac{x - 900}{200}\right) = \Phi\left(\frac{x - 900}{200}\right) = 0.05$$

from the table,

from the table $\Phi(-1.65) = 0.05$

$$\frac{x - 900}{200} = -1.65$$

$$x = 200(-1.65) + 900$$

$$x = \boxed{571}$$