1. $E(x) = (0 \times 0.1) + (1 \times 0.2) + (2 \times 0.3) + (3 \times 0.4)$

$= 0 + 0.2 + 0.6 + 1.2$

$= \underline{2}$

$Var(x) = (0^2 \times 0.1) + (1^2 \times 0.2) + (2^2 \times 0.3) + (3^2 \times 0.4) - 2^2$

$= 0 + 0.2 + 1.2 + 3.6 - 4$

$= \underline{1}$

2.

Judge 1	Judge 2	Rak 1	Rak 2	d	d^2
UK	UK	1	4	-3	9
France	France	2	3	-1	1
Russia	Russia	3	1	2	4
Poland	Poland	4	5	-1	1
Canada	Canada	5	2	3	9
					$\Sigma = 24$

$$r_s = 1 - \frac{6 \Sigma d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 24}{5(25-1)}$$

$$= 1 - \frac{144}{120}$$

$$r_s = -0.2$$

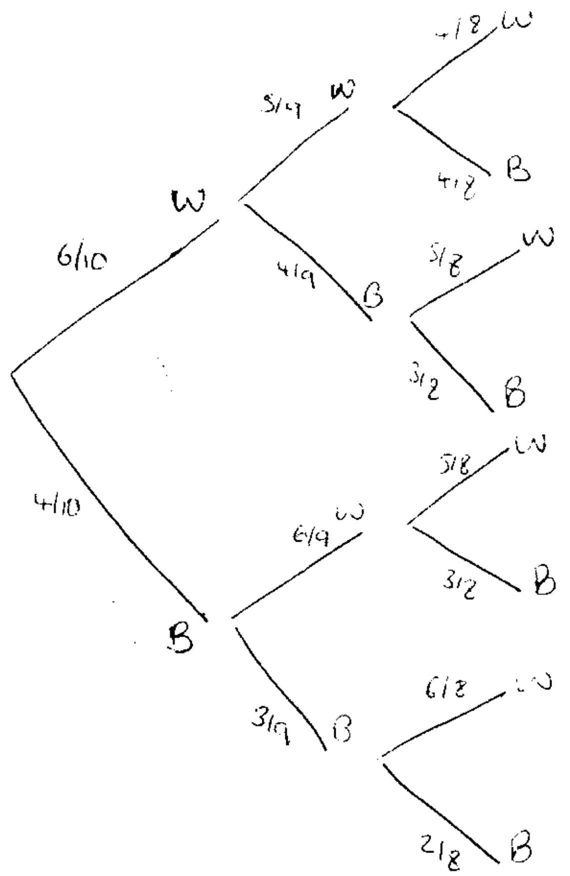
3 i) ${}^{15}C_7 = 6435$

ii) 6 forwards & need 3 $\times$ 9 defenders & need 4

${}^{6}C_3 \times {}^{9}C_4$

$= 2520$

4 6 white, 4 blue, no replacement.



i) a) $3/9$ (from tree diagram)

b) $\left(\frac{4}{10} \times \frac{3}{9}\right) + \left(\frac{6}{10} \times \frac{4}{9}\right) = \frac{2}{5}$

c) $\left(\frac{3}{9} \times \frac{2}{8}\right) + \left(\frac{6}{9} \times \frac{3}{8}\right) = \frac{1}{3}$

3 ii) can't be modelled as geometric as probability is not constant.

5. i) 1991 . 110,000

ii) median = 29
LQ = 25
UQ = 33½

IQ range = 33.5 - 25
= 8.5

Proportion 25 + below $\frac{150}{590} \times 100$ = 25.4%

Proportion 35+ $\frac{110}{590} \times 100$ = 18%

b) Showed that they did not tend to be older in 2001 but younger and also in 2001 the percentage of older mothers was increased.
Also comparing the

6 i) a) $r = \frac{S_{xy}}{\sqrt{S_{xx} S_{xy}}}$

$S_{xy} = \sum x_i y_i - \frac{1}{n} \sum x_i \sum y_i$

$= 767 - \frac{1}{8} \times 60 \times 72 \qquad = 227$

$S_{xx} = \sum x^2 - \frac{1}{n} (\sum x_i)^2$

$= 1148 - \frac{1}{8} \times 60^2 \qquad = 698$

$S_{yy} = \sum y^2 - \frac{1}{n} (\sum y_i)^2$

$= 810 - \frac{1}{8} \times 72^2 \qquad = 162$

$r = \frac{227}{\sqrt{698 \times 162}}$

$r = 0.675$

b) $r_s = +1$ as x and y are ranked in Same order

ii) r - would be closer to 1

r_s - no difference as still ranked in Same order.

iii) 14

iv) one found in part (iii) more reliable as the graph is a curve, the y on x regression line is based on a straight line

7. P = Sucess - $1/4$ = 0.25
q = failure = $3/4$ = 0.75
n = 12

$B(12, 0.25)$

i) fixed number of trials
Constant probability

ii) $P(X \leqslant 6) = 0.9857$ - from tables.

iii) 7 vouchers needed
$P(X \geqslant 7) = 1 - P(X \leqslant 6)$
$= 1 - 0.9857$
$= 0.143$

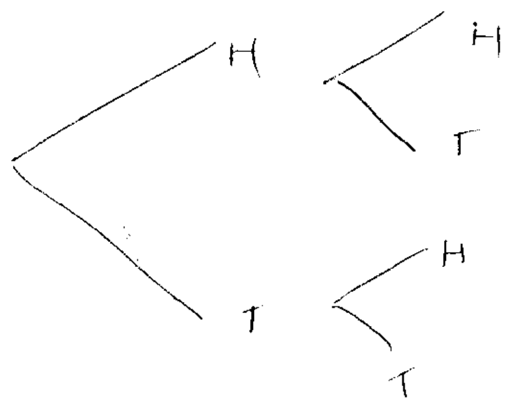
iv) To claim prize in 12th week & not before must have got 6 vouchers in weeks 1 - 11 and 1 voucher in week 12.

So, 6 vouchers in week 1 - 11
$B(11, 0.25)$ X = Prob. getting voucher.
$P(X = 6)$
$= {}^{11}C_6 \times 0.25^6 \times 0.75^5$
$= 0.027663$

P(voucher in 12th)
= 0.25

So P(claim in 12th week & not before) = 0.027663×0.25
= $\underline{6.69 \times 10^{-3}}$

8i)



$P(H, H) = 0.04$
$\therefore P(H) = 0.2$

So $P(T) = 0.8$

$P(T \text{ and } T) = 0.8 \times 0.8$
$= \underline{0.64}$

ii) $P(H) = p$ $P(T) = 1 - p$

P(exactly 1 head) = 0.42
so H and T or T and H = 0.42
$p \times (1-p) + (1-p) \times p = 0.42$
$p(1-p) + p(1-p) = 0.42$

$= 2p(1-p) = 0.42$

So,

$2p - 2p^2 = 0.42$

rearranging

$$2p^2 - 2p + 0.42 = 0$$

$$p^2 - p + 0.21 = 0$$

$$(p - 0.7)(p - 0.3) = 0$$

$$\underline{p = 0.7} \quad \text{or} \quad \underline{p = 0.3}$$

9.i) $Geo(1/5)$ $\quad p = 1/5 \quad q = 4/5$

a) $E(X) = 1/p = 1/\tfrac{1}{5} = 5$

b) $P(X=4) = pq^{x-1}$

$$= \frac{1}{5} \times \left(\frac{4}{5}\right)^3 = 0.102 \left(\frac{64}{625}\right)$$

c) $P(X>4)$ suggests 4 failures

$$\left(\frac{4}{5}\right)^4 = \frac{256}{625}$$

ii) Y, $Geo(p)$ $\quad q = 1 - p$

Show $P(Y \text{ is odd}) = p + q^2 p + q^4 p \ldots$

$P(Y=1) = p$

$P(Y=3) = q^2 p$

$P(Y=5) = q^4 p \ldots$

$P(X=x) pq^{x-1}$

ii b) $c.r = q^2 \quad (1-p)^2$

$$S_\infty = \frac{p}{1-q^2}$$

$$p(\text{odd}) = \frac{1-q}{1-q^2}$$

$$= \frac{1-q}{(1-q)(1+q)}$$

$$= \frac{1}{1+q}$$