Part 1:

Probability, Bayes' theorem

Bayes' theorem: $P(B/A)=\frac{P(A\backslash B)*P(B)}{P(A)}$

Q1: a

B=identical male twins(I.M.T)

A=male twins(M.T)

	male&male	male&female	female&male	female&female
Not identical $\frac{1}{125}$	$\frac{1}{4}=\frac{1}{500}$	$\frac{1}{4}=\frac{1}{250}$	$\frac{1}{4}=\frac{1}{250}$	$\frac{1}{4}=\frac{1}{500}$

	male&male	female&female
Identical $\frac{1}{300}$	$\frac{1}{2}=\frac{1}{600}$	$\frac{1}{2}=\frac{1}{600}$

$$P(\text{I.M.T / M.T})=\frac{P(\text{M.T}\backslash\text{I.M.T})*P(\text{I.M.T})}{P(\text{M.T})}=\frac{1*\frac{1}{600}}{\frac{1}{600}+\frac{1}{500}}=\frac{\frac{1}{600}}{\frac{11}{3000}}=\frac{5}{6}.$$

Q1: b

B=Chocolate (C)

A= bowl number 1 (1)

$$P(C/1)=\frac{P(1\backslash C)*P(C)}{P(1)}=\frac{\frac{3}{4}*\frac{1}{2}}{\frac{5}{8}}=\frac{3}{5}.$$

Q2

B= Yellow and Green (Y.G)

A= Yellow from 1994 (Y 94)

P(Y94/Y.G)= $\frac{0.2*0.2}{0.2*0.2+0.14*0.10} = \frac{0.04}{0.054} = \frac{20}{27}.$

Q3: a

B = Positive (p)

A= Sick (s)

P(P/S)= $\frac{1*\frac{1}{10,000}}{\frac{1}{10,000}+0.01} = \frac{1}{101}$

Q3: b

P(P/S)= $\frac{1*\frac{1}{200}}{\frac{1}{200}+0.01} = \frac{1}{3}$

Random variables

Expected value= $\sum_{i=0}^{n} x_i * P(x_i)$

Q1

Options of Sum={2,3,4,5,6,7,8,9,10,11,12}

Sum divided by 3={3,6,9,12}=

P(sum 3)+P(sum 6)+P(sum 9)+P(sum12)

$\frac{2}{36} + \frac{5}{36} + \frac{4}{36} + \frac{1}{36} = \frac{1}{3}$

P(sum not divided by 3)=1- $\frac{1}{3} = \frac{2}{3}$

$E_{(X)}$= 6* P(win 6$) – 3*P(lose 3$)

= 6*($\frac{1}{3}$) -3*($\frac{2}{3}$)= 2-2 =0 (a fair game)

Q2

P(sum bigger then 12)= P(sum 13)+P(sum 14)+P(sum 15)

$$= \frac{3}{25} + \frac{2}{25} + \frac{1}{25} = \frac{6}{25}$$

P(sum equals to 12)= $\frac{4}{25}$

P(sum smeller then 12) = 1- $\frac{6}{25}$ - $\frac{4}{25}$ = $\frac{3}{5}$

$E_{(X)}$ = 5*$\frac{6}{25}$ - 6*$\frac{3}{5}$ = - $\frac{12}{5}$ (isn't a fair game)

Q3

The number of males in the company is: 0.4*200=80

μ= sample size*Percentage of population in the sample

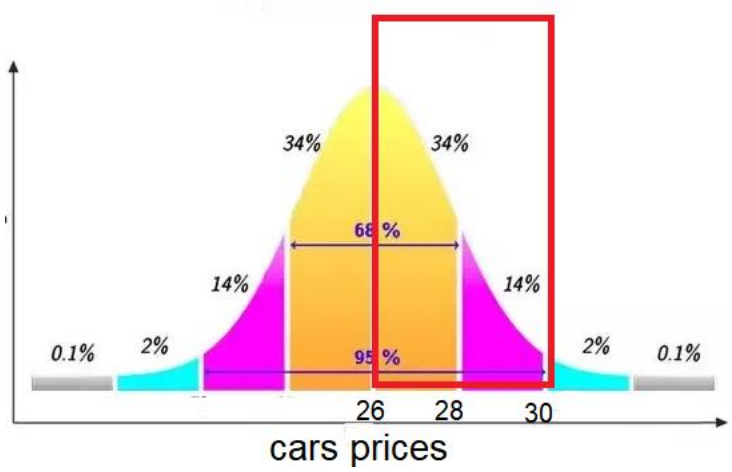
= 0.4*8 = 3.2 (mean)

The Standard deviation of the sample=

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n}(x_i - \mu)^2}{N}}$$

$$6 = \sqrt{\frac{0.4*(1-0.4)}{8}} = 0.1732$$ (Standard deviation)

Q4



X=34%+14%= 48% = 0.48.

Q5

P(X>3)= $\frac{2*0.4}{2}$ = 0.4 (area of the Triangle)

Q6

P($\frac{The\ number\ of\ results\ desired}{Number\ all\ possible\ outcomes}$)=

$\frac{\binom{300}{3}*\binom{200}{1}}{\binom{500}{4}}$ = 0.3462.

Q7

$E_{(X)}$= -10*0.1 -5*0.35 +0 +10*0.1 +5*0.35 = 0.