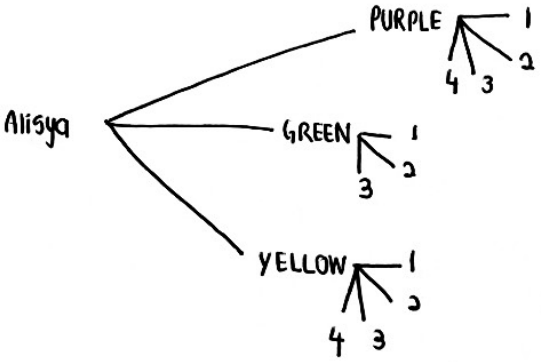
Question 1

1. (a) S = {(PURPLE, 1), (PURPLE, 2), (PURPLE, 3), (PURPLE, 4), (GREEN, 1), (GREEN, 2), (GREEN, 3), (GREEN, 4), (YELLOW, 1), (YELLOW, 2), (YELLOW, 3), (YELLOW, 4)}

(b) {(PURPLE, 1), (PURPLE, 2), (PURPLE, 3), (PURPLE, 4), (GREEN, 1), (GREEN, 2), (GREEN, 3), (YELLOW, 1), (YELLOW, 2), (YELLOW, 3), (YELLOW, 4)}



(c) $1/3 \times 1/4 = 1/12$

2. a) i) $P(S) = \frac{8}{25}$

ii) $P(X) = \frac{10}{25}$

$= \frac{2}{5}$

iii) $P(A) = \frac{10}{25}$

$= \frac{2}{5}$

b) $1 - 0.4$ $\quad$ $0.6(25)$

$= 0.6$ $\quad$ $= 15$

c) $P(S \cap X) = \frac{15}{25} + \frac{8}{25} - \frac{10}{25}$

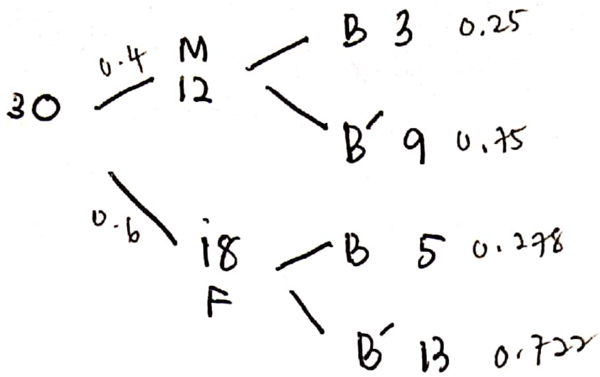
$= \frac{13}{25}$ $\quad$ $\therefore$ 13 computer

d) $P(S)$
not $P(X)$ $= \frac{10}{25} - \frac{3}{25}$

$= \frac{7}{25}$ $\quad$ $\therefore$ 7 computer

Q1

3



a) $P(B) = P(M) \times P(MB) + P(F) \times P(FB)$

$= (0.4 \times 0.1) + (0.6 \times 0.1668)$

$= 0.04 + 0.10008$

$= 0.1401$

b) $P(M|B) = \dfrac{P(M \cap B)}{P(B)}$

$= \dfrac{\cancel{0.0}\ 0.25 \times 0.1}{0.1401}$

$= 0.7138$

c) $P(B) \cup P(MB) = ?$

$P(B) = 0.1401$

$P(MB) = 0.25$

$\therefore P(B) \cup P(MB) = 0.1401 + 0.25$

$= 0.3901$

Question 2

1. (a) $P(X=2) = P(X=0) + P(X=1) + P(X=2)$
$= 1/8 + 3/8 + 3/8$
$= 7/8$

(b) $P(X \geqslant 2) = P(X=2)$
$= 3/8$

(c) $P(X \leq 3) = P(X=3)$
$= 1/8$

(d) $P(X=3) + P(X=0) = 1/8 + 1/8$
$= 2/8 = 1/4$

2. (a) $P(X \geqslant 10) = 0.05$

(b) $P(X \geqslant 10) = P(X=14) + P(X=18)$
$= 0.12 + 0.06$
$= 0.18$

(c) $P(X < 4) = P(X=1) + P(X=3)$
$= 0.11 + 0.07$
$= 0.18$

(d) $P(4 \leq X \leq 9) = P(X=4) + P(X=9)$
$= 0.13 + 0.18$
$= 0.31$

(e) $P(3 < X < 10) = P(X=4) + P(X=7) + P(X=9)$
$= 0.13 + 0.28 + 0.18$
$= 0.59$

f) $P(X=7) - P(X=9) = 0.28 - 0.18$
$= 0.10$

3. (a) $P(X \geq 1) = P(X = 1)$

$= 0.1$

(b) $P(X \geq 3) = P(X = 3)$

$= 0.25$

(c) $P(X \leq 5) = P(X = 5)$

$= 0.1$

(d) $P(2 \leq X \leq 4) = P(X = 2) + P(X = 4)$

$= 0.3 + 0.15$

$= 0.45$

(e) $P(X = 2) + P(X = 4) + P(X = 6) = 0.3 + 0.15 + 0.05$

$= 0.5$

Q3

1) $n = 5000$ $\quad p = 0.2$

$\lambda = np$

$= 5000 \times 0.2 = 100$

$\lambda = 100$

i) $P(x) = \lambda^x \cdot e^{-\lambda} / x!$

ii) $P(x \geq 1) = 1 - P(x < 1)$

$= 1 - P(x=0) + P(x=1)$

$p = 0.02$ $\quad q = 0.98$ $\quad n = 50$

$P(x) = nC_x \, p^x q^{n-x}$

$P(x=0) = 50C_0 \cdot 0.02^0 \cdot 0.98^{50} + P(x1)$

$= 50C_1 \cdot 0.02^1 0.98^{49}$

$= 0.364 + 0.371$

$= 0.735$

$= 1 - 0.735$

$= 0.265$

b) $\frac{20}{5000} = 0.004 = P(\text{defective})$

$\lambda = 20$ $\quad n = 5000$

Let x be number of defectives

find probability of atleast 3 = P(3 or more)

Which $= 1 - P(x = 0, 1, \text{ or } 2)$

$P(x=0) = 20^0 \cdot e^{-20} / 0! = 2.06 \times 10^{-9}$

$P(x=1) = 20^1 \cdot e^{-20} / 1! = 4.12230 \times 10^{-8}$

$P(x=2) = 20^2 \cdot e^{-20} / 2! = 4.122 \times 10^{-7}$

$= 0.0000004$

$1 - 0.0000004 = 0.9999996$

Q3

2 a) $(P\ x = 4)$

$= {}^{12}C_4\,(0.6)^4\,(1-0.6)^8$

$= 0.0420$

b) $P(4 \le x \le 7) = P(x=4) + P(x=5) + P(x=6) + P(x=7)$

$= 0.042 + {}^{12}C_5\,(0.6)^5\,(0.4)^7 + {}^{12}C_6\,(0.6)^6\,(0.4)^6$

$+ {}^{12}C_7\,(0.6)^7\,(0.4)^5$

$= 0.5465$

c) $P(x=2) = {}^nC_x\,p^x\,(1-p)^{n-x}$

$= {}^{12}C_2\,(0.4)^2\,(1-0.4)^{10}$

$= 0.0634$

3) a) $P(3 \le X \le 6)$

$= P(X=3) + P(X=4) + P(X=5) + P(X=6)$

$= {}^{15}C_3\,(0.25)^3\,(0.75)^{12} + {}^{15}C_4\,(0.25)^4\,(0.75)^{11} + {}^{15}C_5\,(0.25)^5\,(0.75)^{10}$

$+ {}^{15}C_6\,(0.25)^6\,(0.75)^9$

$= 0.7072$

b) $P(X < 4)$

$P(X=0) + P(X=1) + P(X=2) + P(X=3)$

${}^{15}C_0\,(0.25)^0\,(0.75)^{15} + {}^{15}C_1\,(0.25)^1\,(0.75)^{14} + {}^{15}C_2\,(0.25)^2\,(0.75)^{13}$

$+ {}^{15}C_3\,(0.25)^3\,(0.75)^{12}$

$= 0.4613$

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c) $P(X > 5)$

$1 - P(X \leq 5)$

$1 - (P(X=0) + P(X=1) + P(X=2) + P(X=3) + P(X=4) + P(X=5))$

$1 - ({}^{15}C_0 (0.25)^0 (0.75)^{15} + {}^{15}C_1 (0.25)^1 (0.75)^{14} + {}^{15}C_2 (0.25)^2 (0.75)^{13}$

$+ {}^{15}C_3 (0.25)^3 (0.75)^{12} + {}^{15}C_4 (0.25)^4 (0.75)^{11}$

$+ {}^{15}C_5 (0.25)^5 (0.75)^{10})$

$= 0.1484$

Question 4

1 a) 1st $\rightarrow$ 2nd $\rightarrow$ 3rd
x x 20%

$p = 0.2$
$x = 3$

$\therefore p(x=3) = (1-0.2)^{3-1}(0.2)$
$= 0.128$ #

b) $7^{th} \rightarrow 20\%$

$x = 7,$
$p = 0.2$

$p(x=7) = (1-0.2)^{7-1}(0.2)$
$= 0.0524$ #

c) mean, $\mu_x = \frac{1}{p}$

$\mu_3 = \frac{1}{0.2}$
$= 5$ #

std. dev, $\sigma_x = \sqrt{\frac{(1-p)}{p^2}}$

$\sigma_3 = \sqrt{\frac{(1-0.2)}{(0.2)^2}}$

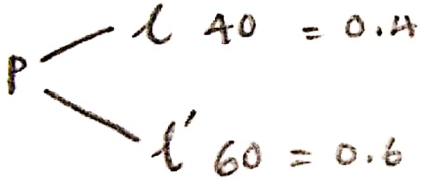
$\sigma_3 = 4.47$

$\sigma_3 = 5$ #

(2) a) Yes, because the possibility outcomes in a sense infinite until the first success happens.

b) x is number of trials until first success is observed.

c)



$p = 0.4,\quad P(1) = (1-0.4)^{1-1}(0.4)$

$x = 1 \qquad\qquad = 0.4$ #

d) $P(X \le 3) = P(X=3) + P(X=2) + P(X=1)$

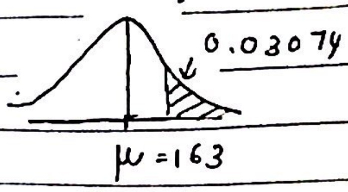
$= (1-0.4)^{3-1}(0.4) + (1-0.4)^{2-1}(0.4) + (1-0.4)^{1-1}(0.4)$

$= 0.144 + 0.24 + 0.4$

$= 0.784$ #

1. male must $\geq$ 178 cm

$\mu = 163$ $\sigma = 8$



a)

$P(x \geq 178)$

$z = \frac{178 - 163}{8}$

$= 1.875$

$P(z = 1.875)$

$= 1 - 0.96926$

$= 0.03074$

percentage $= 0.03074 \times 100\%$

$= 3.07\%$

b) $\cancel{\frac{3.07}{100} \times 5000 = 153.5}$

≈ 153 candidates

c) $\frac{17}{100} \times 5000 = 850$ ← new candidates

$850 - 153 = 697$ ← new candidates added

percentage new candidates $= \frac{697}{5000} \times 100\%$

$= 13.94$

$P(z) = 0.1394$

$z = 1 - 0.1394$

$= 0.8606 \rightarrow$ z table $= 1.09$

$x = z \cdot \sigma + \mu$

$= 1.09(8) + 163$

$= 171.72$

≈ 171 cm

2. cust not turn up, $Q = 0.21$ $\quad p = 0.79$

a) $P(X=30) = 180C30\,(0.21)^{30}\,(1-0.21)^{150}$
$= 0.0271$

b) $P(30 \leq x \leq 35) = P(x=30) + P(x=35)$
$P(x=30) = 180C_{30}\,(0.21)^{30}\,(1-0.21)^{150}$
$= 0.0271$
$P(x=35) = 180C_{35}\,(0.21)^{35}\,(1-0.21)^{145}$
$= 0.0656$

$\therefore\ 0.0271 + 0.0656 = 0.0927$

c) $P(x \geq 25) = 180C_{25}\,(0.21)^{25}\,(1-0.21)^{155}$
$= 0.0042$

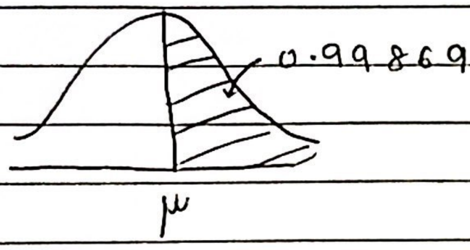
d) $P(x \leq 28) = 180C_{28}\,(0.21)^{28}\,(1-0.21)^{152}$
$= 0.0145$

$\mu = 2.5 \quad \sigma = 0.83$

a) $x > 5.00$

$Z = \dfrac{x - \mu}{\sigma}$ in table $\rightarrow 0.99869$

$= \dfrac{5.0 - 2.5}{0.83}$



$= 3.0120$

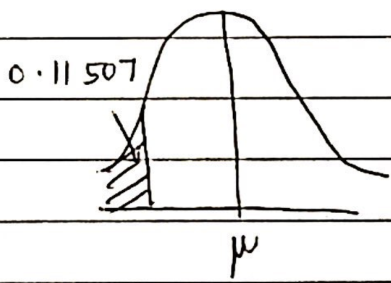
b) $P(Z) = 1 - 0.99869$

$= 0.00131$

c) $\mu = 3.00 \quad \sigma = 1.50$

$P(x < 1.47)$

$Z = \dfrac{1.47 - 3.00}{1.50}$



$= -1.20$

$P(Z) = 0.11507$

percentage $= 0.11507 \times 100\%$

$= 11.51\%$

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