1. No. of parakeets $n(p) = 8$
No. of green parakeets $n(g) = 4$
No. of blue parakeets $n(b) = 4$

In all permutation and combination of all 8 parakeets, below are only 2 possibilities where no adjacent parakeets are of same color.

1) G B G B G B G B
2) B G B G B G B G

Hence Total permutations and combinations of ordering parakeets $n = \frac{n(p)!}{n(g)!\,n(b)!}$

$\therefore n = \frac{8!}{4!\,4!} = 70$

$\therefore$ ~~Pro~~ Probability of no two adjacent parakeets $p = \frac{2}{70} = \boxed{\frac{1}{35}}$

2. Probability of a ~~core~~ computer core being defective $p(d) = 0.3$

$\therefore$ Probability of it being non-defective ~~p(nd)~~ =

$p(nd) = 1 - p(d) = 1 - 0.3 = 0.7$

(a) A CPU has 8 cores which functions independent of each other.

$\therefore$ Probability of all 8 core functioning

$p = (0.7)^8 = 0.05764$

(b) → Extreme model has 8 functioning cores

$\therefore$ Probability of getting extreme model

$p(e) = (0.7)^8 = 0.05764$

$\therefore$ In ~~extreme~~ 1000 CPUs, no. of extreme model

$n(e) = 1000 \times p(e) = 1000 \times 0.05764$

$= 57.64 \approx \boxed{58}$

→ Advance model has at least 8 functioning core

$\therefore$ ~~p(a) = . It has .~~

$\because$ It includes probabilities of having 5 cores, 6, 7 and 8 cores

$$\therefore P(a) = {}^8C_8 (0.7)^8 (0.3)^0 + {}^8C_7 (0.7)^7 (0.1)^1 + {}^8C_6 (0.7)^6 (0.3)^2 + {}^8C_5 (0.7)^5 (0.3)^3 + {}^8C_4 (0.7)^4 (0.3)^4$$

$$P(a) = (1)(0.7)^8 + 8(0.7)^7 (0.1) + 28 (0.7)^6 (0.3)^2 + 56 (0.7)^5 (0.3)^3 + 14 (0.7)^4 (0.3)^4$$

$$P(a) = 0.94203$$

$\therefore$ In 1000 CPU cores, there can be $1000 \times 0.94203 = 942$ model which has at least 4 functioning core which includes exact ~~8~~ models having exact 8 functioning cores.

$\therefore$ No. of advance model $= 942 - 58 = \boxed{884}$

→ Probability of having at least 1 core function = 1 − ~~probability~~ probability of no core functioning

$$\therefore P = 1 - (0.3)^8 = 0.999934$$

$\therefore$ In 1000 CPU ~~cores~~ there are $1000 \times 0.9999 = 999.93 \approx 1000$ ~~core~~ CPU which has at least 1 core functioning which includes advance and extreme models.

∴ No. of great models

$= 1000 - 884 - 58 = \boxed{58}$

→ So No. of Great models = 58

No. of Adv. models = 884

No. of Extreme models = 58

(c) Great model's cost = \$ 50

∴ Revenue from great model = 50×58

Adv. model's cost = \$ 100

∴ Revenue from adv. model = 100×884

Extreme mode's cost = \$ 1000

∴ Revenue from extreme model = 1000×58

$= 58000$

∴ Total Revenue = $2900 + 88400 + 58000$

$= \boxed{\$\ 149300}$

3. Probability of judge voting accused given actually guilty

$P(J=\text{"guilty"} \mid A=\text{"guilty"}) = 0.7$

If defendent is innocent, it drops to 0.2

$\therefore P(J=\text{"guilty"} \mid A=\text{"innocent"}) = 0.2$

70 % accused are guilty

$\therefore P(A=\text{"guilty"}) = 0.7$

a) Judge 1 votes guilty.

$\therefore$ Probability of peson being guilty given judge voted guity

$P(A=\text{"guilty"} \mid J=\text{"guilty"}) = P(\text{"guilty"} \mid \text{"guilty"})$

$$= \frac{P(J=\text{"guilty"} \mid A=\text{"guilty"}) \times P(A=\text{"guilty"})}{P(J=\text{"guilty"})}$$

$$= \frac{0.7 \times 0.7}{P(J=\text{"guilty"} \mid A=\text{"innocen"})\, P(A=\text{"guilty"}) + P(A=\text{"innocen"})\, P(J=\text{"guilty"} \mid A=\text{"innocent"})}$$

$$= \frac{0.49}{(0.7)(0.7) + (0.3)(0.2)} = \frac{0.49}{0.55} = \boxed{0.89}$$

b) All three judges vote guilty.

$\therefore$ We need to find probability that accused is in fact guilty.

$\therefore P(A = \text{"G"} \mid J_1 = G, J_2 = G, J_3 = G)$

$$\therefore P(A \mid J_1, J_2, J_3) = \frac{P(J_1, J_2, J_3 \mid A)\, P(A)}{P(J_1, J_2, J_3)}$$

$P(J_1 = G, J_2 = G, J_3 = G) = \cancel{P(J_1 = G \mid A)}$

$= P(J_1, J_2, J_3 \mid A)\, P(A) + P(J_1 = G \mid A = \text{"I"}) \times P(J_2 = G \mid A = \text{"I"}) \times P(J_3 = G \mid A = \text{"I"}) \times P(A = \text{"I"})$

$= (0.7)(0.7)(0.7)(0.7) + (0.3)(0.2)(0.2)(0.3)$

$= 0.2401 + 0.0024$

$= 0.2425$

$$\therefore P(A \mid J_1 J_2 J_3) = \frac{(0.7)(0.7)(0.7)(0.7)}{0.2425}$$

$$= \frac{0.2401}{0.2425}$$

$$\boxed{= 0.99}$$

c) J_1 & J_2 have voted "innocent"

Probability of judge 3 $P(J = \text{"G"}) \Rightarrow$

$$P(J_3 = G \mid J_1 = I, J_2 = I) = \frac{P(J_1 = I, J_2 = I, J_3 = I)}{P(J_1 = I, J_2 = I)}$$

$$P(J_1 = I, J_2 = I, J = G)$$
$$= \cancel{P(J_1 = I \mid A=G)\, P(J_2 = I \mid A=G)\, P(J_3 = G \mid A=G)\, P(A)}$$
$$\cancel{+ P(J_1 = I \mid A)\, P(J_2 = I \mid A)}$$

$$= P(J_1 = I \mid A = G)\, P(J_2 = I \mid A = G)\, P(J_3 = G \mid A = G)\, P(A=G)$$
$$+ P(J_1 = I \mid A = I)\, P(J_2 = I \mid A = I)\, P(J_3 = G \mid A = I)\, P(A = I)$$
$$= (0.3)(0.3)(0.7)(0.7) + (0.8)(0.8)(0.2)(0.1)$$
$$= 0.0825$$

$$P(J_1 = I, J_2 = I) = P(J_1 = I \mid A = G)\, P(J_2 = I \mid A = G)\, P(A=G)$$
$$+ P(J_1 = I \mid A = I)\, P(J_2 = I \mid A = I)\, P(A = I)$$
$$= (0.3)(0.3)(0.7) + (0.8)(0.8)(0.3)$$
$$= 0.063 + 0.192$$
$$= 0.255$$

$$\therefore P(J_3 = G \mid J_1 = I, J_2 = I) = \frac{P(J_1 = I, J_2 = I, J = G)}{P(J_1 = I, J_2 = I)} = \frac{0.0825}{0.255}$$
$$= 0.3235$$