1. 1) Total permutations $= \frac{7!}{4!} = 210$

innovative, analytical → 2 ia_ _ia

empathetic, innovative → 6 ei_ e_i ie_ i_e _ei _ie

blanks $= \binom{5}{1}$

$(2 \cdot 5) + (5 \cdot 6) = 40$

Duplicates: eia iae → $40 - 2 = 38$

$\frac{38}{210} = \frac{19}{105}$

2) Bernoulli Trial

$\binom{10}{4} \cdot \left(\frac{19}{105}\right)^4 \cdot \left(\frac{86}{105}\right)^6 = 210\left(\frac{19}{105}\right)^4\left(\frac{86}{105}\right)^6 \approx 6.8\%$

2. 1) $P(A) = \frac{1}{2}$ $P(B) = \frac{3}{4}$ $P(A \cap B) = \frac{5}{16}$ use chart below

If independent, $P(A \cap B) = P(A) \cdot P(B)$

$\frac{1}{2} \cdot \frac{3}{4} = \frac{3}{8}$ $\frac{3}{8} \neq \frac{5}{16}$

NOT INDEPENDENT

2) $P(x=0) = \frac{1}{2}$

$P(x=1) = \frac{5}{16}$

$P(x=2) = \frac{1}{8}$

$P(x=3) = \frac{1}{16}$

THTH HTHT HTTH THTT TTHT HTTT TTTH TTTT

HHTT HHTH THHT TTHH HTHH

HHHT THHH

HHHHH

$$E(X) = 0\left(\tfrac{1}{2}\right) + 1\left(\tfrac{5}{16}\right) + 2\left(\tfrac{1}{8}\right) + 3\left(\tfrac{1}{16}\right) = \tfrac{5}{16} + \tfrac{4}{16} + \tfrac{3}{16} = \tfrac{12}{16} = \boxed{\tfrac{3}{4}}$$

3. NASTY $P(X=1) = \frac{1}{5}$ NASTY

$P(X=2) = \frac{3}{5}$ HASTY MATHS BOARD

$P(X=3) = \frac{1}{5}$ HOARD ↔ Equal chance of it being board or hoard

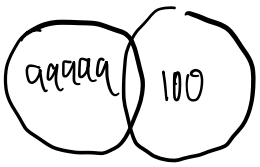
$$E(X) = 1\left(\tfrac{1}{5}\right) + 2\left(\tfrac{3}{5}\right) + 3\left(\tfrac{1}{5}\right) = \tfrac{1}{5} + \tfrac{6}{5} + \tfrac{3}{5} = \tfrac{10}{5} = \boxed{2}$$

HASTY $P(X=1) = \frac{1}{5}$ HASTY

$P(X=2) = \frac{4}{5}$ NASTY MATHS HOARD BOARD

$$E(X) = 1\left(\tfrac{1}{5}\right) + 2\left(\tfrac{4}{5}\right) = \tfrac{1}{5} + \tfrac{8}{5} = \boxed{\tfrac{9}{5}}$$

4. 1) $P(M)$ ← matches description $= 1/1000$ $\quad P(I \cap M)$ ← innocent $= \frac{99}{100000}$



$$P(I|M) = \frac{99}{100000} \div \frac{1}{1000} = \frac{99000}{100000} = \boxed{\frac{99}{100}}$$

2) $P(I) = \frac{99999}{100000}$

$$P(M|I) = \frac{99}{100000} \div \frac{99999}{100000} = \frac{9900000}{9999900000} = \frac{99}{99999} = \boxed{\frac{11}{11111}}$$

3) $1 - \dfrac{\binom{99900}{1000}}{\binom{100000}{1000}}$

not matching

No one in the 1000 matches description

reviewed residents

1 − (none of the 1000 matches) = at least 1 matches

5. $0.7 \cdot 0.8 = 0.56 \rightarrow$ **56%**

Chance of 3 Planets

Chance Earth not detected