1) Letting $X$ be the number of digits incorrectly received, $X$ has a binomial $(10, 1/5)$ distribution. The desired probability is $P(X \geq 3)$, which equals

$$
\sum_{x=3}^{5} \binom{5}{x} (1/5)^x (4/5)^{5-x} = 181/3125 \approx 0.0579.
$$

2) Letting $X$ be the number of heads in the 10 flips, $X$ has a binomial $(10, p)$ distribution, where $p$ is either 0.4 or 0.7. Letting $A$ be the event that $X = 7$, and $B$ be the event that the coin 1 is chosen, the desired probability is

$$
P(A) = P(A|B)P(B) + P(A|B^C)P(B^C) = [P(A|B) + P(A|B^C)](1/2),
$$

which equals

$$
\left[ \binom{10}{7} (0.4)^7 (0.6)^3 + \binom{10}{7} (0.7)^7 (0.3)^3 \right] (1/2) = 0.155.
$$

3) Let $X$ be a geometric $(1/38)$ random variable.

(a) The desired probability is $P(X > 5) = (37/38)^5 = 0.875$.

(b) The desired probability is $P(X = 4) = (37/38)^4 (1/38) = 0.0243$.

4) Since $\text{Var}(2X) = 4 \text{Var}(X)$, the only way $\text{Var}(2X)$ can equal $2 \text{Var}(X)$ is if $\text{Var}(X) = 0$. Since $\text{Var}(X) = p(1-p)$, $p$ must equal either 0 or 1.