1)

Bernoulli....

$p = 0.8 \qquad n = 3 \qquad k = 2 \qquad \begin{matrix} 1\,1\,0 \\ 1\,0\,1 \\ 0\,1\,1 \end{matrix} \binom{3}{2}$

$$A_2 = \binom{3}{2}(0.8)^2(0.2) = (3)(0.8)^2(0.2) = 0.384$$

$$A_3 = \binom{3}{3}(0.8)^3(0.2)^0 = (1)(0.8)^3(0.2)^0 = 0.512$$

$$\boxed{P(k \geq 2) = 0.896}$$

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2) $Y = y$

$$X = \mathcal{N}(\overset{\mu}{2y}, \overset{\sigma}{1}) \qquad f_Y(y) = \begin{cases} 0.5, & y = 1 \\ 0.5, & y = -1 \\ 0, & \text{otherwise} \end{cases}$$

$$f_X(x) = f_X(x \mid y=1)(f_Y(y=1)) + f(x \mid y=-1) f_Y(y=-1)$$

$$\boxed{f_X(x) = \frac{1}{2\sqrt{2\pi}}\left(e^{-\frac{(x-2)^2}{2}} + e^{-\frac{(x+2)^2}{2}}\right)}$$

3) $$P_{XY}(x,y) = \begin{cases} 0.2, & x=-1, y=1 \\ 0.2, & x=1, y=1 \\ 0.3, & x=1, y=2 \\ 0.3, & x=2, y=2 \\ 0, & \text{otherwise} \end{cases}$$

$$P_X(x) = P(x|y=1) + P(x|y=2)$$

a) $$\boxed{P_X(x) = \begin{cases} 0.2, & x=-1 \\ 0.5, & x=1 \\ 0.3, & x=2 \\ 0, & \text{otherwise} \end{cases}}$$

b) $$\boxed{P_Y(y) = \begin{cases} 0.4, & y=1 \\ 0.6, & y=2 \\ 0, & \text{otherwise} \end{cases}}$$

c) They are not <u>independent</u>: $P_{XY}(-1,1) \neq P_X(-1)P_Y(1)$

$$R_{XY} = \overset{0}{\cancel{(0.2)(-1) + (0.2)(1)}} + \overset{.6}{(0.3)(2)} + \overset{1.2}{(0.3)(4)} = 1.8$$

$$\frac{1.8}{\sigma_X \sigma_Y} \neq 0$$

<u>Correlated</u>

d) $$\boxed{P_{X|Y=2}(x|y=2) = \begin{cases} 0.5, & x=1 \\ 0.5, & x=2 \\ 0, & \text{otherwise} \end{cases}}$$