HW 3

1) Problem 2.17 (a) – (c).

2) Problem 2.40.

3) Problem 3.1.

4) A biased coin with *P*({head})=0.6 is tossed three times. Let the binomial random variable *X* represent the number of heads obtained on any triple toss. Find (or sketch) the PMF of *X*.

5) Determine which of the following are valid distribution functions (CDFs). Justify your answer.
Hint: you can use MATLAB to plot and verify the properties of the CDF for the range of *x*.

   a. $F_X(x) = \begin{cases} 1 - e^{-\frac{x}{2}} & x \geq 0 \\ 0 & x < 0 \end{cases}$

   b. $F_X(x) = \begin{cases} 0 & x < 0 \\ 0.5 + 0.5\cos\left(\frac{\pi(x-1)}{2}\right) & 0 < x \leq 2 \\ 1 & x \geq 2 \end{cases}$

   c. $F_X(x) = \frac{x}{a}\left(u(x-a) - u(x-2a)\right)$, where $u(x)$ is the unit step function.

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HOMEWORK # 3

1. (a) $\binom{8}{2}_C = \frac{8!}{2!(8-2)!} = \frac{8!}{2!6!} = 28$

(b) $(1-P)P(1-P)(1-P)(1-P)P(1-P)(1-P) = P^2(1-P)^6$

(c) $Pr[\text{2 bits error}] = \binom{8}{2}_C \cdot P^2(1-P)^6$
$= 28P^2(1-P)^6$

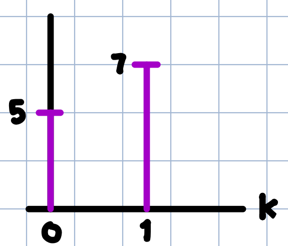
2. (a) $Pr[1_R] = Pr[1_R/1_S] \cdot Pr[1_S] + Pr[1_R/0_S] \cdot Pr[0_S]$
$= 7/9 \cdot 1/2 + 1/9 \cdot 1/2 = 8/18 = 4/9$

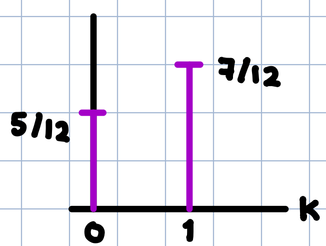
(b) $Pr[\text{error}] = Pr[\text{error} \mid 1_S] \cdot Pr[1_S] + Pr[\text{error} \mid 0_S] \cdot Pr[0_S]$
$= 2/9 \cdot 1/2 + 1/9 \cdot 1/2 = 3/18 = 1/6$

(c) $Pr[1_S \mid 1_R] = \frac{Pr[1_R \mid 1_S] \cdot Pr[1_S]}{Pr[1_R]} = \frac{7/9 \cdot 1/2}{4/9} = 7/8$

3. (a) $n(k=0) = 5$
$n(k=1) = 7$

(b) $P_R[k=0] = 5/12$
$P_R[k=1] = 7/12$



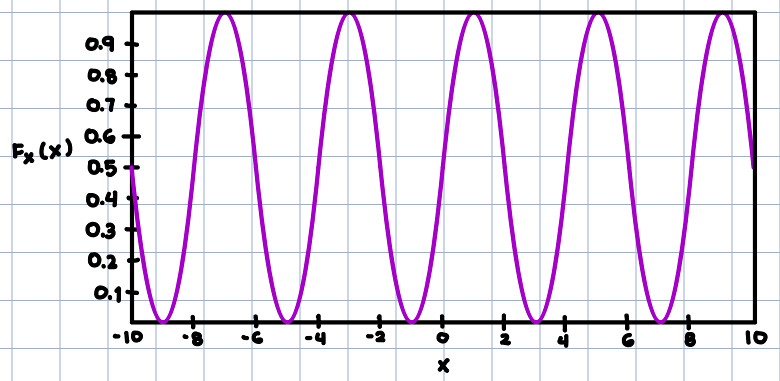


4. $P\{X=0\} = \binom{3}{0}(0.6)^0(0.4)^3 = 0.064$
$P\{X=1\} = \binom{3}{1}(0.6)^1(0.4)^2 = 0.288$
$P\{X=2\} = \binom{3}{2}(0.6)^2(0.4)^1 = 0.432$
$P\{X=3\} = \binom{3}{3}(0.6)^3(0.4)^0 = 0.216$

5. (a) $G(-\infty) = 0$, $G_x(\infty) = 1$, $G_x(x_2) > G_x(x_1)$
if $x_2 > x_1 \longrightarrow G_x(x^+) = G_x(x)$

VALID DISTRIBUTION

(b) $F_x(x) = 0.5 + 0.5\cos[\pi/2\,(x-1)]$



NOT A VALID DISTRIBUTION

(c) $G_x(\infty) \neq 1$

NOT A VALID DISTRIBUTION