EES 315: In-Class Exercise # 18

Instructions

1. Work alone or in a group of no more than three students. **The group cannot be the same as any of your former groups after the midterm.**
2. Only one submission is needed for each group.
3. You have two choices for submission:
   (a) Online submission via Google Classroom
   - PDF only.
   - Only for those who can directly work on the posted files using devices with pen input.
   - Paper size should be the same as the posted file.
   - No scanned work, photos, or screen capture.
   - Your file name should start with the 10-digit student ID of one member. (You may add the IDs of other members, exercise #, or other information as well.)

   (b) Hardcopy submission
4. **Do not panic.**

Date: 6 / 11 / 2020			
Name	ID (last 3 digits)		

1. Consider the random variable specified in each part below.
   (a) Write down its (minimal) support.
   (b) Find $P[X \le \pi]$. Your answer should be of the form 0.XXXX.

	(minimal) support	$P[X \le \pi]$
$X \sim \mathcal{G}_0(0.4)$	The minimal support of any Geometric$_0$ RV is $\{0,1,2,\dots\}$.	$p_X(x) = \begin{cases} p(1-p)^x, & x = 0,1,2,\dots, \\ 0, & \text{otherwise.} \end{cases}$ The possible values of X are 0,1,2, ... Among these, only 0,1,2,3 satisfies the condition "$\le \pi$". Therefore, $P[X \le \pi] = p_X(0) + p_X(1) + p_X(2) + p_X(3)$ $= p(1-p)^0 + p(1-p)^1 + p(1-p)^2 + p(1-p)^3$ $= 0.4(1 + 0.6 + 0.6^2 + 0.6^3) \approx 0.8704.$
$X \sim \mathcal{P}(0.4)$	The minimal support of any Poisson RV is $\{0,1,2,\dots\}$.	$p_X(x) = \begin{cases} e^{-\alpha}\frac{\alpha^x}{x!}, & x = 0,1,2,\dots, \\ 0, & \text{otherwise.} \end{cases}$ The possible values of X are 0,1,2, ... Among these, only 0,1,2,3 satisfies the condition "$\le \pi$". Therefore, $P[X \le \pi] = p_X(0) + p_X(1) + p_X(2) + p_X(3)$ $= e^{-0.4}\frac{0.4^0}{0!} + e^{-0.4}\frac{0.4^1}{1!} + e^{-0.4}\frac{0.4^2}{2!} + e^{-0.4}\frac{0.4^3}{3!}$ $\approx 0.9992.$

2. [ENRPa] A certain binary-symmetric communication channel has a crossover probability (bit-error rate) of 0.4. Assume bit errors occur independently. For each of the random variables defined below, indicate the **<u>name and the parameter(s)</u>** of the family it belongs to.

Random Variable	Family
Consider the situation when 7 bits are input into this channel. Let $N =$ the number of bit errors at the channel output.	$\mathcal{B}(7,0.4)$
Consider the situation when a sequence of bits $b_1 b_2 b_3 \cdots$ are input into this channel. Let $L =$ the index of the bit that corresponds to the ***first*** bit error at the channel output.	$\mathcal{G}_1(0.4)$