Name:

1) Suppose that you draw 3 cards from a deck of cards with replacement and record whether the suit is black or red. Let X be the total number of red cards.

a) Determine the mass of X. Hint: List all of the possibilities with each possibility being equally likely.

b) Draw a graphical representation of the mass (Fig. 8.1 right)

c) If instead of a 52 card deck, you have a 100 card deck consisting of p red cards. Let Y be the total number of red cards drawn when you draw 3 cards with replacement from this nonstandard deck of cards. Please confirm that when p = 0.5, the answers match part a). Hint: Combinations, are the colors independent?

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2) We want to know the probability that the next car that passes you on the road is blue (1), red (2) or silver (3) or some other color (0). However, we misplaced the mass and only kept the CDF.

$$F_X(x) = \begin{cases} 0 & x < 0\\ 0.369 & 0 \le x < 1\\ 0.584 & 1 \le x < 2\\ 0.816 & 2 \le x < 3\\ 1 & 3 \le x \end{cases}$$

a) Verify that this is a valid CDF. Hint: Remarks 8.5, 8.7, 8.9.

b) Give the following CDF, what is the mass?

c) Using the mass, calculate the following probabilities. Please show your work.

- 1) P(X = 2)
- 2) P(X > 1)
- 3) P(1 < X < 4)
- 4)  $P(1 \le X < 3)$
- 5)  $P(1 < X \le 3)$

3) Given the following mass:

Х	0	1	2	7	9	10	12
p <sub>i</sub> (x)	0.14	0.22	0.19	0.22	0.09	0.12	0.02

a) Verify that this is a valid mass. Hint: Remarks 8.5, 8.6.

a) Calculate the CDF of X.

b) Draw a plot of the CDF.

c) Using the CDF, calculate the following probabilities.

1) P(X = 7)

2) P( 2 < X < 10)

3) P( 2 ≤ X < 10)

4) P( 2 < X ≤ 10)

5) P( 2 ≤ X ≤ 10)

4) We are playing a very simplified version of blackjack in which each person is only dealt 2 cards. Let X be the sum of the cards. Let Y be the color of the first card that is drawn. If the color is red, then Y = 1, if the color is black then color = 2. Note: In Blackjack, aces can be 1 or 11 and all face cards are worth 10 points.

a) Is X a random variable? Please explain.

b) Is X continuous or discrete? Why?

c) What are the possible values for X?

d) Is Y a random variable? Please explain.

e) If Y is a random variable, is it continuous or discrete?

f) If Y is a random variable, what are the possible values for Y?

g) In this scenario, name one discrete random variable, W, and one continuous random variable, Z, which are distinct from X and Y. Please explain your answer and provide the possible values for each of them.

h) When opening a container of 32 toy ballet dancers performing pirouettes, let A denote the number of broken dancers, and let B denote the number of whole (unbroken) dancers. Write C = A/B, i.e., C is the ratio of broken dancers to whole dancers. What complication arises in this definition of C as a random variable?