

## 4.S: Random Variables (Solutions- Practice + Homework)

1.

Table 4.S. 1

$x$	$P(x)$
0	0.12
1	0.18
2	0.30
3	0.15
4	0.10
5	0.10
6	0.05

3.  $0.10 + 0.05 = 0.15$

5. 1

7.  $0.35 + 0.40 + 0.10 = 0.85$

9.  $1(0.15) + 2(0.35) + 3(0.40) + 4(0.10) = 0.15 + 0.70 + 1.20 + 0.40 = 2.45$

11.

Table 4.S. 2

$x$	$P(x)$
0	0.03
1	0.04
2	0.08
3	0.85

13. Let  $X$  = the number of events Javier volunteers for each month.

15.

Table 4.S. 3

$x$	$P(x)$
0	0.05
1	0.05
2	0.10
3	0.20
4	0.25
5	0.35

17.  $1 - 0.05 = 0.95$

18.  $X$  = the number of business majors in the sample.

19. 2, 3, 4, 5, 6, 7, 8, 9

20.  $X$  = the number that reply "yes"

22. 0, 1, 2, 3, 4, 5, 6, 7, 8

24. 5.7

26. 0.4151

28.  $X$  = the number of freshmen selected from the study until one replied "yes" that same-sex couples should have the right to legal marital status.

30. 1, 2, ...

32. 1.4

35. 0, 1, 2, 3, 4, ...

37. 0.0485

39. 0.0214

41.  $X$  = the number of U.S. teens who die from motor vehicle injuries per day.

43. 0, 1, 2, 3, 4, ...

45. No

48.

a.  $X$  = the number of pages that advertise footwear

b. 0, 1, 2, 3, ..., 20

c. 3.03

d. 1.5197

50.

a.  $X$  = the number of Patriots picked

b. 0, 1, 2, 3, 4

c. Without replacement

53.  $X$  = the number of patients calling in claiming to have the flu, who actually have the flu.  $X = 0, 1, 2, \dots, 25$

55. 0.0165

57.

a.  $X$  = the number of DVDs a Video to Go customer rents

b. 0.12

c. 0.11

d. 0.77

59. 4.43

61. c

63.

- $X$  = number of questions answered correctly

- $X \sim B(32, 13)(32, 13)$

- We are interested in MORE THAN 75% of 32 questions correct. 75% of 32 is 24. We want to find  $P(x > 24)$ . The event "more than 24" is the complement of "less than or equal to 24."

- $P(x > 24) = 0$

- The probability of getting more than 75% of the 32 questions correct when randomly guessing is very small and practically zero.

65.

a.  $X$  = the number of college and universities that offer online offerings.

b. 0, 1, 2, ..., 13

- c.  $X \sim B(13, 0.96)$
- d. 12.48
- e. 0.0135
- f.  $P(x = 12) = 0.3186$   $P(x = 13) = 0.5882$  More likely to get 13.

67.

- $X$  = the number of fencers who do **not** use the foil as their main weapon
- 0, 1, 2, 3,... 25
- $X \sim B(25, 0.40)$
- 10
- 0.0442
- The probability that all 25 not use the foil is almost zero. Therefore, it would be very surprising.

69.

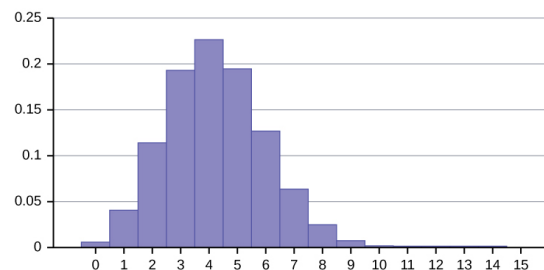
- a.  $X$  = the number of audits in a 20-year period
- b. 0, 1, 2, ..., 20
- c.  $X \sim B(20, 0.02)$
- d. 0.4
- e. 0.6676
- f. 0.0071

71.

- 1.  $X$  = the number of matches
- 2. 0, 1, 2, 3
- 3. In dollars: -1, 1, 2, 3
- 4. 1212
- 5. The answer is -0.0787. You lose about eight cents, on average, per game.
- 6. The house has the advantage.

73.

- a.  $X \sim B(15, 0.281)$



- b. i. Mean  $= \mu = np = 15(0.281) = 4.215$
- ii. Standard Deviation  $= \sigma = \sqrt{npq} = \sqrt{15(0.281)(0.719)} = 1.7409$
- c.  $P(x > 5) = 1 - 0.7754 = 0.2246$   
 $P(x = 3) = 0.1927$   
 $P(x = 4) = 0.2259$   
It is more likely that four people are literate than three people are.

75.

- a.  $X$  = the number of adults in America who are surveyed until one says he or she will watch the Super Bowl.
- b.  $X \sim G(0.40)$
- c. 2.5
- d. 0.0187
- e. 0.2304

77.

- a.  $X$  = the number of pages that advertise footwear
- b.  $X$  takes on the values 0, 1, 2, ..., 20
- c.  $X \sim B(20, 2919229192)$
- d. 3.02
- e. No
- f. 0.9997
- g.  $X$  = the number of pages we must survey until we find one that advertises footwear.  $X \sim G(2919229192)$
- h. 0.3881
- i. 6.6207 pages

79. 0, 1, 2, and 3

81.

- a.  $X \sim G(0.25)$
- b. i. Mean =  $\mu = 1/p = 1/0.25 = 4$   
ii. Standard Deviation =  $\sigma = 1/\sqrt{p} = 1/\sqrt{0.25} = 2$
- c.  $P(X = 10) = 0.0188$
- d.  $P(X = 20) = 0.0011$
- e.  $P(X \leq 5) = 0.7627$

82.

- a.  $X \sim P(5.5); \mu = 5.5; \sigma = \sqrt{5.5} \approx 2.3452$
- b.  $P(X \leq 6) \approx 0.6860$
- c. There is a 15.7% probability that the law staff will receive more calls than they can handle.
- d.  $P(X > 8) = 1 - P(X \leq 8) \approx 1 - 0.8944 = 0.1056$

84.

Let  $X$  = the number of defective bulbs in a string.

Using the Poisson distribution:

- $\mu = np = 100(0.03) = 3$
- $X \sim P(3)$
- $P(X \leq 4) \approx 0.8153$

Using the binomial distribution:

- $X \sim B(100, 0.03)$
- $P(X \leq 4) = 0.8179$

The Poisson approximation is very good—the difference between the probabilities is only 0.0026.

86.

- a.  $X$  = the number of children for a Spanish woman
- b. 0, 1, 2, 3, ...
- c. 0.2299
- d. 0.5679
- e. 0.4321

88.

- a.  $X$  = the number of fortune cookies that have an extra fortune
- b. 0, 1, 2, 3, ... 144
- c. 4.32
- d. 0.0124 or 0.0133
- e. 0.6300 or 0.6264
- f. As  $n$  gets larger, the probabilities get closer together.

90.

- a.  $X$  = the number of people audited in one year
- b. 0, 1, 2, ..., 100
- c. 2
- d. 0.1353
- e. 0.3233

92.

- a.  $X$  = the number of shell pieces in one cake
- b. 0, 1, 2, 3,...
- c. 1.5
- d. 0.2231
- e. 0.0001
- f. Yes

94. d

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