4.1.1 Lab 8

Lab – Discrete Distributions

Name: Key

Learning Objectives: Find the Mean, Variance and Standard Deviation of a Probability Distribution using the Calculator. Find probabilities with a table.

VIDEO LINK: https://www.youtube.com/watch?v=cI8lCZoJr1c&t=0s

Include the units in each of your answers, wherever appropriate.

Baiers Electronics manufactures computer parts that are supplied to many computer companies. Despite the fact that two quality control inspectors at Baiers Electronics check every part for defects before it is shipped to another company, a few defective parts do pass through these inspections undetected. Let x denote the number of defective computer parts in a shipment of 400. The following table gives the probability distribution of x.

x	0	1	2	3	4	5
$p(x)$	.02	.20	.30	.30	.10	.08

1. Find the mean of the distribution given above. 1. 2.5 defective parts

2. Find the standard deviation of the probability distribution. 2. 1.2 defective parts

3. Find the variance of the probability distribution. 3. 1.45 parts^2

The maximum patent life for a new drug is 17 years. Subtracting the length of time required by the FDA for testing and approval of the drug provides the actual patent life of the drug—that is, the length of time that a company has to recover research and development costs and make a profit. Suppose the distribution of the lengths of patent life for new drugs is as shown here:

Years, x	3	4	5	6	7	8	9	10	11	12	13
$p(x)$	.03	.05	.07	.10	.14	.20	.18	.12	.07	.03	.01

4. Find the expected number of years of patent life for a new drug. 4. 7.9 years

5. Find the standard deviation of the probability distribution. 5. 2.17 years

6. Find the variance of the probability distribution. 6. 4.73 years^2

LAB

The H2 Hummer limousine has eight tires on it. A fleet of 1300 H2 limos was fit with a batch of tires that mistakenly passed quality testing. The following table lists the frequency distribution of the number of defective tires on the 1300 H2 limos.

Number of defective tires	0	1	2	3	4	5	6	7	8
Number of H2 limos	59	224	369	347	204	76	18	2	1

7. ***Construct a probability distribution table*** for the numbers of defective tires on these limos. Let x denote the number of defective tires on a randomly selected H2 limo. List your table in the space below this question.

X	0	1	2	3	4	5	6	7	8
P(X)	$\frac{59}{1300}$	$\frac{224}{1300}$	$\frac{369}{1300}$	$\frac{347}{1300}$	$\frac{204}{1300}$	$\frac{76}{1300}$	$\frac{18}{1300}$	$\frac{2}{1300}$	$1/1300$

8. If you randomly select a limo from this fleet, how many defective tires would you *expect* it to have?

8. 2.56 tires

9. Find the mean of the probability distribution. 9. 2.56 tires

x	P(x)
0.	

10. Find the standard deviation of the probability distribution. 10. 1.32 tires

11. Find the variance of the probability distribution. 11. 1.75 tires^2

Find the following probabilities.

12. $P(x = 3)$ $= 347/1300$ 12. 0.27

13. $P(2 \leq x \leq 4)$ $= P(2)+P(3)+P(4)$

$= \frac{369}{1300} + \frac{347}{1300} + \frac{204}{1300}$ 13. 0.71

14. $P(x \geq 3)$ 14. 0.50

$= P(3)+P(4)+P(5)+P(6)+P(7)+P(8)$

15. $P(x > 4)$ 15. 0.07

$= P(x \geq 5) = P(5)+P(6)+P(7)+P(8)$

16. Would any of the probabilities from the previous four questions be considered unusual? Explain your reasoning.

No, since none of the probabilities are less than 5%

LAB

The maximum patent life for a new drug is 17 years. Subtracting the length of time required by the FDA for testing and approval of the drug provides the actual patent life of the drug—that is, the length of time that a company has to recover research and development costs and make a profit. Suppose the distribution of the lengths of patent life for new drugs is as shown here:

Years, x	3	4	5	6	7	8	9	10	11	12	13
$p(x)$	.03	.05	.07	.10	.14	.20	.18	.12	.07	.03	.01

Find the following probabilities.

17. $P(5)$ — 17. 0.07

18. $P(x = 10)$ — 18. 0.12

19. $P(6 \le x \le 9)$ $= P(6) + P(7) + P(8) + P(9)$
$= .10 + .14 + .20 + .18$ — 19. 0.62

20. $P(x \ge 5)$ — 20. 0.92
$= P(5) + P(6) + P(7) + \dots + P(12) + P(13)$

21. $P(x > 4) = P(x \ge 5)$ — 21. 0.92

22. $P(x > 10) = P(x \ge 11)$ — 22. 0.11
$= P(11) + P(12) + P(13)$

LAB

Years, x	3	4	5	6	7	8	9	10	11	12	13
$p(x)$	.03	.05	.07	.10	.14	.20	.18	.12	.07	.03	.01

Find the following probabilities.

23. $P(x \geq 6)$ — 23. 0.85

$= P(6) + P(7) + P(8) + \dots + P(12) + P(13)$

24. $P(x < 11)$ — 24. 0.89

$= P(x \leq 10)$

$= P(3) + P(4) + P(5) + \dots + P(12) + P(13)$

25. $P(x < 7)$ — 25. 0.25

$= P(x \leq 6)$

$= P(3) + P(4) + P(5) + P(6)$

26. $P(x \leq 12)$ — 26. 0.99

4.2.1 Lab 8

Lab – Discrete Distributions Name: Key

Learning Objectives: Find probabilities with a table. Find binomial probabilities. Find the Mean, Variance and Standard Deviation of a Binomial Distribution. Expected value problems.

Defective Parts Baiers Electronics manufactures computer parts that are supplied to many computer companies. Despite the fact that two quality control inspectors at Baiers Electronics check every part for defects before it is shipped to another company, a few defective parts do pass through these inspections undetected. Let x denote the number of defective computer parts in a shipment of 400. The following table gives the probability distribution of x.

x	0	1	2	3	4	5
$p(x)$	.02	.20	.30	.30	.10	.08

1. How many defective computer parts would you expect to receive in a shipment of 400?

mean

1. 2.5

Find each probability below.

2. What is the probability that a shipment of 400 computer parts has no defective parts?

$P(X=0)$ or $P(0)$

2. 0.02

3. What is the probability that at least one computer part in a shipment of 400 is defective?

$P(x \geq 1)$

3. 0.98

4. What is the probability that less than four computer parts in a shipment of 400 are defective?

$P(x < 4) = P(x \leq 3)$

4. 0.82

LAB

Hospital ER A review of emergency room records at a rural hospital was performed to determine the probability distribution of the number of patients entering the emergency room during a 1-hour period. The following table lists the distribution.:

Patients per hour, x	0	1	2	3	4	5	6	7	8	9	10
Probability, $p(x)$	.03	.05	.07	.10	.14	.20	.18	.12	.07	.03	.01

5. How many patients are expected to enter the emergency room during a 1-hour period?

mean

5. 4.9

6. What is the standard deviation of the number of patients entering the emergency room during a 1-hour period?

6. 2.17

Find the following probabilities.

7. What is the probability that the number of patients entering the emergency room during a 1-hour period is at least two?

$P(x \geq 2)$

7. 0.98

8. What is the probability that the number of patients entering the emergency room during a 1-hour period is not more than eight?

$P(x \leq 8)$

8. 0.96

9. What is the probability that the number of patients entering the emergency room during a 1-hour period exceeds eight?

$P(x > 8) = P(x \geq 9)$

9. 0.04

LAB

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Patients per hour, x	0	1	2	3	4	5	6	7	8	9	10
Probability, $p(x)$	.03	.05	.07	.10	.14	.20	.18	.12	.07	.03	.01

Find the following probabilities.

10. What is the probability that the number of patients entering the emergency room during a 1-hour period is less than nine?

$P(x < 9) = P(x \leq 8)$

10. 0.96

11. Would it be unusual to have more than eight patients enter the emergency room during a 1-hour period? (*Hint: use the 5% rule introduced in Section 3.1*)

no since $P(x > 8)$ is not less than 5%

11. no

12. $P(x > 7)$ $= P(x \geq 8)$

12. 0.11

13. $P(x < 3)$ $= P(x \leq 2)$

13. 0.15

14. $P(5)$

14. 0.20

15. Graph the probability distribution in the space below.