

The following exam consists of 40 questions, each worth 2.5 points. You will have 75 minutes to complete the test. This means that you have, on average, about 1 minute, 50 seconds per question.

1. Record your answer to each question on the scantron sheet provided. You are welcome to write on this exam, but your scantron will record your graded answer.
2. Read carefully, and check your answers. Don't let yourself write nonsense.
3. Keep your eyes on your own paper. If you believe that someone sitting near you is cheating, raise your hand and quietly inform me or the instructor of this. I'll keep an eye peeled, and your anonymity will be respected.
4. If any question seems unclear or ambiguous to you, do your best to answer the question and write down your comments, and I will look into it when I grade the test.
5. Be sure you correctly record your student number on your scantron, and blacken in the corresponding digits. **Failure to do so will cost you 10 points on this exam!**

Pledge: On my honor as a JMU student, I pledge that I have neither given nor received unauthorized assistance on this examination.

Signature _____

Two different tests are made for TEST 2. If you have any questions regarding the test, please write them down. I will look into them when I grade the test.

=POISSON(x, λ, cumulative)

=SUM (range)

=MEDIAN (range)

=AVERAGE (range)

=QUARTILE(range, 1 or 2 or 3)

=BINOMDIST(x,n,p,cumulative)

=STDEV(range)

=MODE(range)

$$\mu = E(X) = \sum_{i=1}^N X_i P(X_i) \quad \sigma^2 = \sum_{i=1}^N [X_i - E(X)]^2 P(X_i)$$

$$P(X = x) = \frac{n!}{x!(n-x)!} = p^x (1-p)^{n-x}$$

$$\mu = E(X) = np \quad \sigma^2 = np(1-p) \quad P(X = x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

$$P(A | B) = \frac{P(A \cap B)}{P(B)}$$

$$P(B | A) = \frac{P(A \cap B)}{P(A)}$$

$$P(A \cap B) = P(A | B)P(B) = P(B | A)P(A)$$

The problem below is associated with Questions 1 and 2.

Researchers suspect that the average number of units earned per semester by college students is rising. A researcher at JMU wishes to estimate the number of units earned by students during the spring semester at JMU. To do so, he randomly selects 100 student transcripts and records the number of units each student earned in the spring term. He found that the average number of semester units completed was 12.96 units per student.

1. Identify the population of interest to the researcher.
 - a). all JMU students
 - b). all JMU students enrolled in the spring
 - c). all college students
 - d). all college students enrolled in the spring
2. Identify the variable of interest to the researcher.
 - a). the number of students enrolled at JMU during the spring term
 - b). the average indebtedness of JMU students enrolled in the spring
 - c). the age of JMU students enrolled in the spring
 - d). the number of units earned by JMU students during the spring term
3. Which descriptive summary measures are considered to be resistant statistics?
 - a) the median and interquartile range
 - b) the arithmetic mean and standard deviation
 - c) the interquartile range and range
 - d) the mode and variance

The problem below is associated with Questions 4 to 13.

The Harrisonburg Police Department (HPD) must write tickets daily to keep department revenues at budgeted levels. Suppose the number of tickets written per day is a random variable and follows a Poisson distribution with a mean of 4 tickets per day.

4. For a random variable to be Poisson distributed, it must meet several assumptions. Identify which one of the following choices is NOT an assumption for Poisson distribution.
 - a). The chance of two tickets written at the same time is practically zero.
 - b). The chance of a ticket written at one moment of the day is the same as the chance of the ticket written at any other moment of the day.
 - c). The arrival (written) of a ticket at one moment has no influence on whether a ticket arrives (is written) during any other moment of a day.
 - d). The variance of the number of tickets written per day can be 16.
5. What is the probability that three tickets are written on a randomly selected day?
 - a). 0.2381
 - b). 0.1465
 - c). 0.1954
 - d). 0.8046
6. What is the probability that less than three tickets are written on a randomly selected day? You could find the answer by typing which of the following Excel function?
 - a). =POISSON(2,4,TRUE)
 - b). =POISSON(3,4,TRUE)
 - c). =POISSON(4,3,TRUE)
 - d). =POISSON(2,4,FALSE)
7. What is the probability that more than 3 tickets are written on a randomly selected day?
 - a). 0.7619
 - b). 0.5665
 - c). 0.4335
 - d). 0.8046
8. What is the probability that two or less tickets are written on a randomly selected day?
 - a). 0.7619
 - b). 0.1465
 - c). 0.2381
 - d). 0.1954
9. What is the probability that the number of tickets written is great than or equal to 3 and less than or equal to 7 on a randomly selected day? You could find the answer by typing which of the following Excel function?
 - a). =POISSON(6,4,TRUE)-POISSON(2,4,TRUE)
 - b). =POISSON(7,4,TRUE)-POISSON(2,4,TRUE)
 - c). =POISSON(6,4,TRUE)-POISSON(3,4,TRUE)
 - d). =POISSON(7,4,TRUE)-POISSON(3,4,TRUE)

10. What is the probability that four or more tickets are written on a randomly selected day?
 a). 0.1954 b). 0.3712 c). 0.4335 d). 0.5665
11. What is the probability that the number of tickets written is great than 2 and less than or equal to 6 on a randomly selected day?
 a). 0.7977 b). 0.3488 c). 0.6512 d). 0.5470
12. Consider these three statements concerning the Poisson distribution for the number of tickets written per day. Identify the correct statements.
 I. The mean is 4 tickets per day.
 II. The standard deviation is 4 tickets per day.
 III. The Poisson distribution has two parameters, e.g. its mean and its standard deviation.
- a). I only b). I and II only c). I and III only d). II and III only
13. An office manager is interested in the number of typos on a page by the newly hired secretary. The secretary has 12 typos as the average on a page during her first week testing of 100 pages. Which of the following statements is correct for the office manager to get the answer for his question?
 I. A Poisson distribution with the mean 12 typos can be used.
 II. A Binomial distribution with the mean 12 typos and sample size 100 pages can be used.
- a). I and II only b). I only c). II only d). Neither I nor II

The problem below is associated with Questions 14 to 23.

The Harrisonburg Police Department (HPD) must write tickets daily to keep department revenues at budgeted levels. The tickets written could be a warning ticket without fine or a ticket with fines. Suppose the warning tickets are 20 percent of the total tickets written daily. Chief Harper is interested in the number of warning tickets among total 10 tickets written in a randomly selected day. The number of warning tickets can be represented by W . W is a random variable and follows a Binomial distribution.

14. For a random variable to be Binomial distributed, it must meet several assumptions. Identify which one of the following choices is NOT an assumption for Binomial distribution.
 a). Whether any given ticket is a warning ticket is independent from whether any other given ticket is a warning ticket.
 b). Each ticket is either a warning ticket or it is not a warning ticket.
 c). The probability that any given ticket will be a warning ticket is always the same.
 d). The probability for a ticket to be a warning ticket is changing from 5 percent to 35 with the average as 20 percent.
15. What is the probability that three warning tickets are written on a randomly selected day?
 a). 0.7987 b). 0.8791 c). 0.2013 d). 0.3020
16. What is the probability that less than three warning tickets are written on a randomly selected day? You could find the answer by typing which of the following Excel function?
 a). =BINOMDIST(3,10,0.20,TRUE)
 b). =BINOMDIST(2,10,0.20,TRUE)
 c). =1-BINOMDIST(3,10,0.20,TRUE)
 d). =BINOMDIST(10,2,0.20,TRUE)
17. What is the probability that more than 3 warning tickets are written on a randomly selected day?
 a). 0.3222 b). 0.2013 c).0.8791 d). 0.1209
18. What is the probability that two or less warning tickets are written on a randomly selected day?
 a). 0.3222 b). 0.6778 c). 0.3758 d). 0.3020
19. What is the probability that the number of warning tickets written is great than or equal to 3 and less than or equal to 7 on a randomly selected day? You could find the answer by typing which of the following Excel function?
 a). =BINOMDIST(6,10,0.2,TRUE)-BINOMDIST(2,10,0.2,TRUE)
 b). =BINOMDIST(6,10,0.2,TRUE)-BINOMDIST(3,10,0.2,TRUE)
 c). =BINOMDIST(7,10,0.2,TRUE)-BINOMDIST(3,10,0.2,TRUE)
 d). =BINOMDIST(7,10,0.2,TRUE)-BINOMDIST(2,10,0.2,TRUE)

20. What is the probability that four or more warning tickets are written on a randomly selected day?
 a). 0.1209 b). 0.8791 c). 0.0328 d). 0.0881
21. What is the probability that the number of warning tickets written is great than 2 and less than or equal to 6 on a randomly selected day?
 a). 0.6233 b). 0.3158 c).0.3213 d). 0.6178
22. Consider these three statements concerning the Binomial distribution for the number of warning tickets written per day. Identify the correct statements.
 I. The 20 percent of tickets written per day are warning tickets.
 II. The variance of the number of warning tickets is 1.6.
 III. The Binomial distribution has two parameters, e.g. the percentage of warning tickets per day and the total number of tickets written in a randomly selected day.
- a). I only b). I and II only c). I and III only d). 1, II and III
23. An insurance company wants to determine if the company has an unusually high number of false insurance claims. It is known that the industry proportion for false claims is 3%. The company has decided to randomly and independently sample 100 of the company's insurance claims. They believe the number of these 100 that are false will yield the information the company desires. What type of probability distribution will the company most likely employ to analyze the insurance claims in the problem?
 I. A Binomial distribution with the mean 3 false claims can be used.
 II. A Binomial distribution with the proportion for false claims 3% and the sample size 100 claims can be used.
- a). I only b). I and II only c). II only d). Neither I nor II

The problem below is associated with Questions 24 to 29.

The Harrisonburg Police Department (HPD) must write tickets daily to keep department revenues at budgeted levels. The following table summarizes the dollar amount for a ticket and the proportion of total tickets in that category.

Dollar Amount (x)	P(x)	x p(x)	$[x-E(x)]^2 p(x)$	
\$10	0.20	2.00	266.45	
\$30	0.25	7.50	68.06	
\$60	0.40	24.00	72.90	
\$80	0.10	8.00	112.23	
\$100	0.05	5.00	143.11	
Sum for Each:	326	1.00	46.50	662.75

24. Based on the problem and the information in the Table above, identify which statement below is NOT correct?
 I. The Table is a probability distribution for the dollar amount of a ticket.
 II. The Table associates a dollar amount of a ticket with its corresponding probability of occurrence for each possible dollar amount in the sample space.
 III. The Table assigns a dollar amount to the variability in the sample space.
- a). I only b). II and III only c). III only d). II only
25. Based on the problem and the information in the Table above, identify which statement below is correct?
 I. The mean dollar amount of a ticket is \$56.
 II. The standard deviation of the dollar amount of a ticket is \$25.75.
 III. The mean and the variance of the random variable, the dollar amount of a ticket, are always equal.
- a). I and III only b). II only c). I only d). II and III only.
26. Based on the information in the Table, What is the average dollar amount of a ticket written?
 a). \$60 b). \$56 c). \$46.50 d). \$662,75
27. Officer Smarty wrote a ticket Saturday night, what is the chance that the dollar amount of the ticket is no more than \$30?
 a). 0.20 b). 0.45 c). 0.55 d). 0.80

28. Officer Smarty wrote a ticket Saturday night, what is the chance that the dollar amount of the ticket is between \$20 and \$90?
 a). 0.75 b). 0.65 c). 0.50 d). 0.40
29. Officer Smarty wrote a ticket Saturday night, what is the chance that the dollar amount of the ticket is more than \$60?
 a). 0.45 b). 0.85 c). 0.55 d). 0.15

The problem below is associated with Questions 30 to 35.

The Harrisonburg Police Department (HPD) must write tickets daily to keep department revenues at budgeted levels. The Table below summarizes the dollar amount of a ticket written versus the time of the day (day or night) when a ticket is written in the last year.

\$Amount	$\leq \$30$	\$30.01 to \$89.99	$\geq \$90$	Total
Day	5	10	15	30
Night	20	25	25	70
Total	25	35	40	100

30. Based on the problem and the information in the Table above, identify which statement is NOT correct?
 I. The events for a ticket amount to be $\leq \$30$ or $\geq \$90$ are mutually exclusive.
 II. The events for a ticket amount to be $\leq \$30$ or $\geq \$90$ are collectively exhaustive.
 III. The event for a ticket to be written during the day and the dollar amount to be $\leq \$30$ is a union event.
 a). I only b). II only c). III only d). II and III only
31. For two events: Written during the Day and the dollar amount to be $\geq \$90$, in this problem to be independent, which statement is correct?
 I. The marginal probability for the dollar amount to be $\geq \$90$ is equal to the probability for the dollar amount to be $\geq \$90$ given the ticket is written during the Day
 II. $P(\text{Day}|\geq \$90)$ is equal to $P(\text{Day})$
 III. The probability for the dollar amount to be $\geq \$90$ is equal to the probability for a ticket to be written during the day.
 a). I only b). II only c). I and II only d). III only
32. What is the probability for a ticket to be written during the day?
 a). 0.30 b). 0.286 c). 0.20 d). 0.167
33. What is the probability that a ticket is written at night and the dollar amount is $\leq \$30$?
 a). 0.80 b). 0.75 c). 0.20 d). 0.95
34. What is the probability that a ticket is either written during the day or the dollar amount is $\geq \$90$?
 a). 0.55 b). 0.15 c). 0.70 d). 0.375
35. Among the tickets written at night, what is the probability that the dollar amount of a ticket is $\geq \$90$?
 a). 0.250 b). 0.357 c). 0.400 d). 0.625

The problem below is associated with Questions 36 to 38.

The Harrisonburg Police Department (HPD) must write tickets daily to keep department revenues at budgeted levels. The Table below lists the dollar amount of tickets written and the number of tickets with a specific dollar amount during a day.

Dollar Amount (x)	Freq
30	2
60	1
90	3

36. What is the average dollar amount of tickets written during a day?
 a). \$60 b). \$75 c). \$65 d). \$90
37. What is the median dollar amount of tickets written during a day?
 a). \$75 b). \$65 c). \$60 d). \$90

38. The Table below, as part of a spreadsheet, lists the dollar amount of five tickets written during a day. Which is the correct Excel function to be used to compute the median amount of tickets written during a day?

	A	B	C	D	E	F
5	\$ Amount	30	30	30	60	90
6						

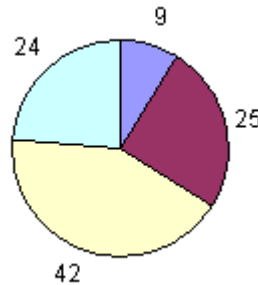
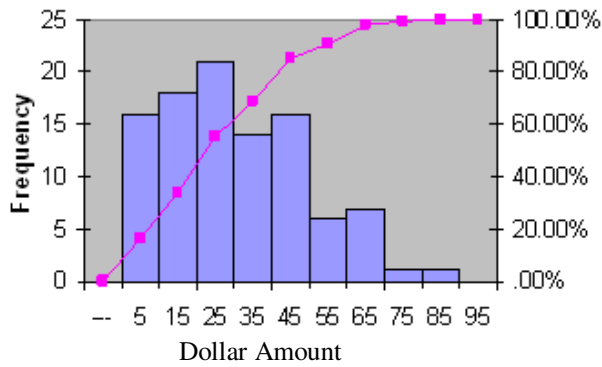
- I. MEDIAN(A5:F5)
- II. =QUARTILE(A5:F5,2)
- III. =QUARTILE(A5:F5,1)
- IV. =MEDIAN(A5:F5)

- a). I and II only
- b). II and IV only
- c). III and IV only
- d). II and III only

The problem below is associated with Questions 39 and 40.

The Harrisonburg Police Department (HPD) must write tickets daily to keep department revenues at budgeted levels. Chief Harper wants to analyze in more detail the dollar amount of 100 tickets written in the last year. The information is presented in the two graphs below.

- 39. What fraction of tickets in the last year was written in the second and third quarters?
 - a). 49%
 - b). 34%
 - c). 24%
 - d). 25%
- 40. What fraction of tickets written in the last year has a dollar amount more than \$20?
 - a). 10% to 20%
 - b). 30% to 40%
 - c). 60% to 70%
 - d). 70% to 80%



9% First Quarter
 24% Second Quarter
 25% Third Quarter
 42% Fourth Quarter

=BINOMDIST(X # successes, n # trials, p(x) prob of success, cumulative)

Binomial Probability Distribution for $x = x$

n	x	p								
		0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
3	0	0.7290	0.5120	0.3430	0.2160	0.1250	0.0640	0.0270	0.0080	0.0010
	1	0.2430	0.3840	0.4410	0.4320	0.3750	0.2880	0.1890	0.0960	0.0270
	2	0.0270	0.0960	0.1890	0.2880	0.3750	0.4320	0.4410	0.3840	0.2430
	3	0.0010	0.0080	0.0270	0.0640	0.1250	0.2160	0.3430	0.5120	0.7290
5	0	0.5905	0.3277	0.1681	0.0778	0.0313	0.0102	0.0024	0.0003	0.0000
	1	0.3281	0.4096	0.3602	0.2592	0.1563	0.0768	0.0284	0.0064	0.0005
	2	0.0729	0.2048	0.3087	0.3456	0.3125	0.2304	0.1323	0.0512	0.0081
	3	0.0081	0.0512	0.1323	0.2304	0.3125	0.3456	0.3087	0.2048	0.0729
	4	0.0005	0.0064	0.0284	0.0768	0.1563	0.2592	0.3602	0.4096	0.3281
	5	0.0000	0.0003	0.0024	0.0102	0.0313	0.0778	0.1681	0.3277	0.5905
10	0	0.3487	0.1074	0.0282	0.0060	0.0010	0.0001	0.0000	0.0000	0.0000
	1	0.3874	0.2684	0.1211	0.0403	0.0098	0.0016	0.0001	0.0000	0.0000
	2	0.1937	0.3020	0.2335	0.1209	0.0439	0.0106	0.0014	0.0001	0.0000
	3	0.0574	0.2013	0.2668	0.2150	0.1172	0.0425	0.0090	0.0008	0.0000
	4	0.0112	0.0881	0.2001	0.2508	0.2051	0.1115	0.0368	0.0055	0.0001
	5	0.0015	0.0264	0.1029	0.2007	0.2461	0.2007	0.1029	0.0264	0.0015
	6	0.0001	0.0055	0.0368	0.1115	0.2051	0.2508	0.2001	0.0881	0.0112
	7	0.0000	0.0008	0.0090	0.0425	0.1172	0.2150	0.2668	0.2013	0.0574
	8	0.0000	0.0001	0.0014	0.0106	0.0439	0.1209	0.2335	0.3020	0.1937
	9	0.0000	0.0000	0.0001	0.0016	0.0098	0.0403	0.1211	0.2684	0.3874
	10	0.0000	0.0000	0.0000	0.0001	0.0010	0.0060	0.0282	0.1074	0.3487
n	x	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
p										

=POISSON(X # successes, λ mean, cumulative)

Poisson Probability Distribution for $x = x$

X	λ									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
0	0.6065	0.3679	0.2231	0.1353	0.0821	0.0498	0.0302	0.0183	0.0111	0.0067
1	0.3033	0.3679	0.3347	0.2707	0.2052	0.1494	0.1057	0.0733	0.0500	0.0337
2	0.0758	0.1839	0.2510	0.2707	0.2565	0.2240	0.1850	0.1465	0.1125	0.0842
3	0.0126	0.0613	0.1255	0.1804	0.2138	0.2240	0.2158	0.1954	0.1687	0.1404
4	0.0016	0.0153	0.0471	0.0902	0.1336	0.1680	0.1888	0.1954	0.1898	0.1755
5	0.0002	0.0031	0.0141	0.0361	0.0668	0.1008	0.1322	0.1563	0.1708	0.1755
6	0.0000	0.0005	0.0035	0.0120	0.0278	0.0504	0.0771	0.1042	0.1281	0.1462
7	0.0000	0.0001	0.0008	0.0034	0.0099	0.0216	0.0385	0.0595	0.0824	0.1044
8	0.0000	0.0000	0.0001	0.0009	0.0031	0.0081	0.0169	0.0298	0.0463	0.0653
9	0.0000	0.0000	0.0000	0.0002	0.0009	0.0027	0.0066	0.0132	0.0232	0.0363
10	0.0000	0.0000	0.0000	0.0000	0.0002	0.0008	0.0023	0.0053	0.0104	0.0181
...
X	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
λ										