Name: ______________________________

Instructor: ___________________________

Math 10120, Exam 3
November 15, 2016

- The Honor Code is in effect for this examination. All work is to be your own.
- You may use a calculator .
- The exam lasts for 1 hour and 15 min.
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 12 pages of the test.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice	______________
11.	______________
12.	______________
13.	______________
14.	______________
Total	______________

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Multiple Choice

1.(6 pts.) The following frequency table shows the number of pets owned by 31 students at Notre Dame. Find the **median**, M, for the set of data.

$x = \#Pets$	Frequency
0	10
1	5
2	7
3	3
4	1
5	3
10	2

(a) 2 (b) 1 (c) 1.5 (d) 2.5 (e) 3

2.(6 pts.) The Temperature readings at Noon in the town of Wagga Wagga for a random sample of 20 days are given in the following table:

Temerature	Frequency
60	2
61	1
62	5
65	9
67	2
70	1

The average temperature in the sample is $\bar{x} = 64$ (there is no need to check this). What is the sample standard deviation ?
(The answers have been rounded off to two decimal places.)

(a) $s = 1.99$ (b) $s = 2.5$ (c) $s = 6.53$ (d) $s = 2.55$ (e) $s = 3.94$

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3.(6 pts.) A box contains four cards.

- One card has the number 1 written on it,
- two cards have the number 2 written on them and
- one has the number 5 written on it.

An experiment consists of drawing a sample of two cards from the box. Let X denote the sum of the numbers that appear on the cards drawn. Which of the following gives the probability distribution of the random variable X?

(a)

X	P(X)
3	1/6
4	2/6
6	2/6
7	1/6

(b)

X	P(X)
2	1/16
3	1/4
4	1/4
6	1/8
7	1/4
10	1/16

(c)

X	P(X)
3	2/6
4	1/6
6	1/6
7	2/6

(d)

X	P(X)
1	1/4
2	1/2
5	1/4

(e)

X	P(X)
1	1/2
2	1
5	1/2

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4.(6 pts.) At a carnival game, the player plays \$1 to play and then rolls a pair of fair six-sided dice. The outcomes are:

$$\begin{matrix} \{(1,1) & (1,2) & (1,3) & (1,4) & (1,5) & (1,6) \\ (2,1) & (2,2) & (2,3) & (2,4) & (2,5) & (2,6) \\ (3,1) & (3,2) & (3,3) & (3,4) & (3,5) & (3,6) \\ (4,1) & (4,2) & (4,3) & (4,4) & (4,5) & (4,6) \\ (5,1) & (5,2) & (5,3) & (5,4) & (5,5) & (5,6) \\ (6,1) & (6,2) & (6,3) & (6,4) & (6,5) & (6,6)\} \end{matrix}$$

If the sum of the numbers on the uppermost face of the dice is 9 or higher, the game attendant gives the player \$A. Otherwise, the player receives nothing from the attendant. Let X denote the net earnings for the player for this game. Find the value of A which makes the game fair (i.e. $E(X) = 0$).

(a) $A = \$0.26$ (b) $A = \$2$ (c) $A = \$2.6$

(d) $A = \$3.6$ (e) $A = \$1$

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5.(6 pts.) The probability distribution of a random variable X given below, find $E(X)$.

k	Pr(X = k)
-1	$\frac{1}{2}$
0	$\frac{1}{8}$
1	$\frac{1}{16}$
2	$\frac{1}{16}$
3	$\frac{1}{4}$

(a) $-\frac{1}{4}$ (b) $\frac{1}{16}$ (c) $-\frac{3}{8}$ (d) $\frac{7}{16}$ (e) $\frac{1}{4}$

6.(6 pts.) A random variable X has the following probability distribution:

X	P(X)
-10	1/10
0	1/10
1	6/10
2	2/10

The expected value is $E(X) = 0$ (you don't need to check this). Which of the following gives the standard deviation of X?

(a) $\sqrt{\frac{114}{30}}$ (b) $\frac{114}{10}$ (c) $\frac{114}{30}$ (d) $\sqrt{\frac{114}{10}}$ (e) $\sqrt{\frac{13}{10}}$

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7.(6 pts.) An archer has a probability of 0.7 of hitting the center of the target on each attempt. Let X denote the number of times she will hit the target in her next 500 attempts. Assuming her performance on each attempt is independent of her performance on previous attempts, what is the expected value ($E(X)$) and standard deviation ($\sigma(X)$) of X?
Note: All numbers are rounded to two decimal places.

(a) $E(X) = 320, \quad \sigma(X) = 25.54$

(b) $E(X) = 350, \quad \sigma(X) = 105$

(c) $E(X) = 250, \quad \sigma(X) = 20.25$

(d) $E(X) = 250, \quad \sigma(X) = 4.5$

(e) $E(X) = 350, \quad \sigma(X) = 10.25$

8.(6 pts.) A fair four sided die (with sides labelled 1-4) is rolled 5 times, what is the probability of getting at least two fours?

(a) $C(5,2)\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^3$

(b) $C(5,0)\left(\frac{1}{4}\right)^0\left(\frac{3}{4}\right)^5 + C(5,1)\left(\frac{1}{4}\right)^1\left(\frac{3}{4}\right)^4$

(c) $\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^3 + \left(\frac{1}{4}\right)^3\left(\frac{3}{4}\right)^2 + \left(\frac{1}{4}\right)^4\left(\frac{3}{4}\right)^1 + \left(\frac{1}{4}\right)^5\left(\frac{3}{4}\right)^0$

(d) $\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^3$

(e) $1 - \left[C(5,0)\left(\frac{1}{4}\right)^0\left(\frac{3}{4}\right)^5 + C(5,1)\left(\frac{1}{4}\right)^1\left(\frac{3}{4}\right)^4\right]$

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9.(6 pts.) If Z is a standard normal random variable, what is $P(-0.5 \leq Z \leq 1.5)$.

Note You will find tables for the standard normal distribution at the end of the exam.

(a) 0.2417 (b) 0.6247 (c) 0.9332 (d) 0.3085 (e) 0.8413

10.(6 pts.) The time a customer spends waiting to be seated at Mama Vino's restaurant on Friday night is normally distributed with mean 10 minutes and standard deviation 2.5 minutes. If you go to Mama Vino's next Friday night, what is the probability that you will have to wait longer than 13 minutes to be seated?

Note You will find tables for the standard normal distribution at the end of the exam.

(a) 0.8849 (b) 0.9987 (c) 0.1151 (d) 0.1358 (e) 0.0013

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Partial Credit

You must show your work on the partial credit problems to receive credit!

Where applicable, answers may be given in the form of products of numbers and symbols for factorials and symbols for numbers of permutations and combinations.

11.(12 pts.) At a fairground game stand, you pay \$1 to play. You then throw 3 darts at a target from a distance of 20 feet. When you are done, the game attendant gives you \$2 for every time you hit the target. Let X denote the (net) earnings for the player for one play of this game. Suppose your probability of hitting the target on each throw is .4 and the outcomes on throws are independent of each other.

(a) Use the binomial probability distribution to write out the probability distribution for X when you are the player.

X	Pr(X)

(b) What is $E(X)$ (the expected value of X) for the probability distribution you found in Part (a)?

(c) If you played this game 30 times, how much would you expect to win? (assuming your chances of hitting the target remain the same throughout).

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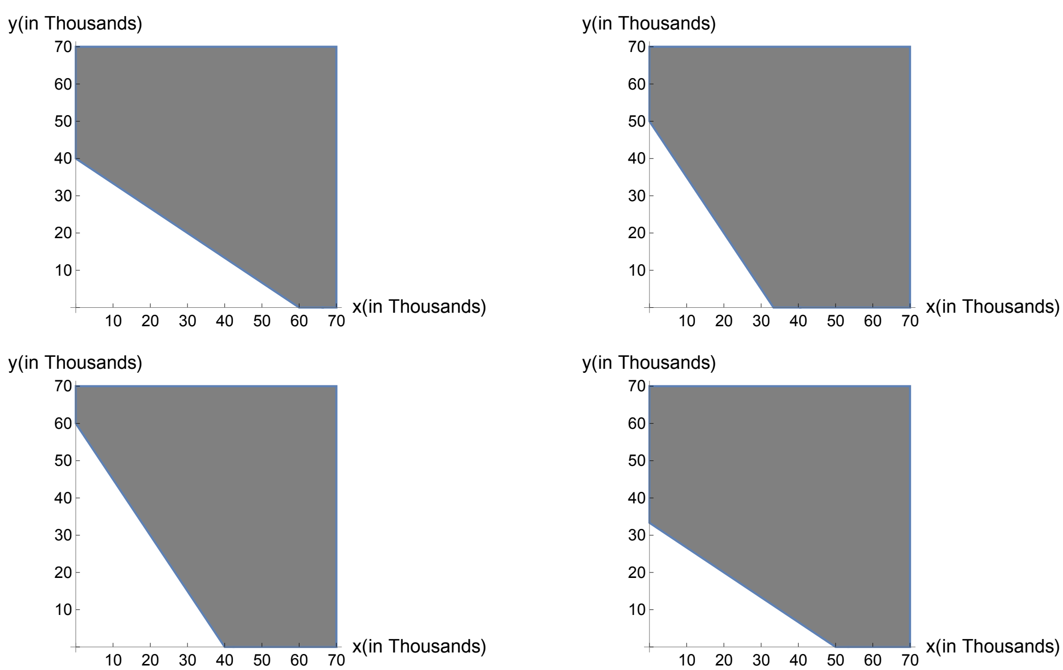
12.(10 pts.) Melinda McNulty is running for election in Mathland. In the final two weeks of the election campaign her campaign managers will devote \$x to running local TV adds in Region X and \$y to running TV ads in Region Y. The campaign statistician tells the managers to expect to attract an average of 0.6 new voters (in favor of Melinda) per dollar spent on local TV ads in Region X and to attract an average of 0.4 new voters (in favor of Melinda) per dollar spent on local TV ads in Region Y.

(a) Melinda needs the sum of new voters from both regions to be at least 20,000. Express this constraint as an inequality in the variables x and y:

(b) If the campaign managers spend \$20,000 on TV ads in Region X and \$10,000 on TV ads in Region Y, will they attract enough new voters to meet their requirements?

(c) Circle the shaded region below which shows the graph of the inequality from part (a) along with the constraints $x \geq 0$ and $y \geq 0$? **Note** that the values of x and y are given in thousands, i.e. $10 = 10000, 20 = 20000$ etc...



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13.(16 pts.) Joe took admissions tests for two different apprenticeship programs. Test scores were normally distributed for both exams. The table below shows the mean and standard deviations for both exams along with Joe's score on each.

	Exam 1	Exam 2
Mean (μ)	72	55
Standard Deviation (σ)	8	12
Joe's Score	84	76

(a) Compute Joe's z-score on Exam 1.

(b) Compute Joe's z-score on Exam 2.

(c) On which test did Joe perform better relative to the other test takers?

(d) What percentage of students who took Exam 1 had a score <u>less than or equal to</u> Joe's score of 84?

(e) What percentage of students who took Exam 2 had a score <u>greater than equal to</u> Joe's score of 76?

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14.(2 pts.) You will receive these two points if your instructor can read your (full) name on the cover page AND you have marked your answers on the cover page with an X (as opposed to an O or any other symbol).

Rough Work

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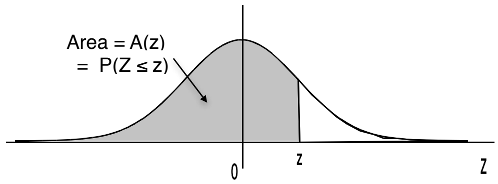
Areas under the Standard Normal Curve



z	$A(z)$	z	$A(z)$	z	$A(z)$	z	$A(z)$	z	$A(z)$
−3.50	.0002	−2.00	.0228	−.50	.3085	1.00	.8413	2.50	.9938
−3.45	.0003	−1.95	.0256	−.45	.3264	1.05	.8531	2.55	.9946
−3.40	.0003	−1.90	.0287	−.40	.3446	1.10	.8643	2.60	.9953
−3.35	.0004	−1.85	.0322	−.35	.3632	1.15	.8749	2.65	.9960
−3.30	.0005	−1.80	.0359	−.30	.3821	1.20	.8849	2.70	.9965
−3.25	.0006	−1.75	.0401	−.25	.4013	1.25	.8944	2.75	.9970
−3.20	.0007	−1.70	.0446	−.20	.4207	1.30	.9032	2.80	.9974
−3.15	.0008	−1.65	.0495	−.15	.4404	1.35	.9115	2.85	.9978
−3.10	.0010	−1.60	.0548	−.10	.4602	1.40	.9192	2.90	.9981
−3.05	.0011	−1.55	.0606	−.05	.4801	1.45	.9265	2.95	.9984
−3.00	.0013	−1.50	.0668	.00	.5000	1.50	.9332	3.00	.9987
−2.95	.0016	−1.45	.0735	.05	.5199	1.55	.9394	3.05	.9989
−2.90	.0019	−1.40	.0808	.10	.5398	1.60	.9452	3.10	.9990
−2.85	.0022	−1.35	.0885	.15	.5596	1.65	.9505	3.15	.9992
−2.80	.0026	−1.30	.0968	.20	.5793	1.70	.9554	3.20	.9993
−2.75	.0030	−1.25	.1056	.25	.5987	1.75	.9599	3.25	.9994
−2.70	.0035	−1.20	.1151	.30	.6179	1.80	.9641	3.30	.9995
−2.65	.0040	−1.15	.1251	.35	.6368	1.85	.9678	3.35	.9996
−2.60	.0047	−1.10	.1357	.40	.6554	1.90	.9713	3.40	.9997
−2.55	.0054	−1.05	.1469	.45	.6736	1.95	.9744	3.45	.9997
−2.50	.0062	−1.00	.1587	.50	.6915	2.00	.9772	3.50	.9998
−2.45	.0071	−.95	.1711	.55	.7088	2.05	.9798		
−2.40	.0082	−.90	.1841	.60	.7257	2.10	.9821		
−2.35	.0094	−.85	.1977	.65	.7422	2.15	.9842		
−2.30	.0107	−.80	.2119	.70	.7580	2.20	.9861		
−2.25	.0122	−.75	.2266	.75	.7734	2.25	.9878		
−2.20	.0139	−.70	.2420	.80	.7881	2.30	.9893		
−2.15	.0158	−.65	.2578	.85	.8023	2.35	.9906		
−2.10	.0179	−.60	.2743	.90	.8159	2.40	.9918		
−2.05	.0202	−.55	.2912	.95	.8289	2.45	.9929		