AMS 5 **Midterm** Fall 2015

Name: Key Section:

Directions:
You may use a calculator, and a single page of notes. Place your name, and section identifier at the top of **each** page. Try to Relax, and Good Luck.

Question	Score
1)	#/9
2)	#/12
3)	#/14
4)	#/10
Extra Credit)	#/10
Total	#/45

AMS 5 **Midterm** Fall 2015

Name: Key Section:_____ Score: (9)

1), 3) Two biologists, Billy and Bobby, are fighting about the best way to collect data for determining which type of ground cover is best for fast banana slug movement.

Billy claims to be an expert banana slug hunter, so naturally he has a favorite place in the forest for observing banana slugs. Billy sets up a single video camera at his favorite banana slug viewing tree. In front of the video camera he fashions a stage that is half covered in normal forest leaf litter and half tiled in linoleum. He then simply records the banana slugs moving across the stage however they choose. After video taping for one full day, he watches the resulting video and obtains the speed of each slug, making sure to keep track of which ground covering each slug decides to use.

Bobby uses the same stage as Billy, but instead of sitting and waiting for slugs to come to him, he randomly samples the forest, and places each slug that he finds on the stage. Bobby is uncomfortable about letting the banana slugs choose which side of the stage that they want to move across, as in Billy's study, so instead he randomly assigns each slug to move across a particular ground cover treatment on the stage (i.e. leaf litter or linoleum).

(2) a) Assume the banana slug speeds were measured in meters per 100 seconds ($\frac{m}{100s}$). From the following list of terms, circle any terms which accurately describe these banana slug speed data.

Quantitative Qualitative Discrete Continuous

(2) b) What is the point of using the leaf litter/linoleum stage?

A Basis for Comparison, A control.

(2) c) Identify, and briefly explain, one potentially confounding factor (PCF) that may be present in one, or more, of the studies listed above.

* Any Valid PCF is Acceptable

Billy's Study is an observational Study. Thus the choice of ground cover by the slugs is Confounding. Maybe Fast slugs always choose linoleum (or vice versa).

(3) d) Assuming each study is carried out exactly as planned, which study should provide more accurate results about the effect of ground cover on banana slug speeds? Why?

Bobby's study is better, because He assigns slugs to treatment/control thus Removing the above PCF.

AMS 5 **Midterm** Fall 2015

Name: Key Section: _____ Score: 12

2), 4) The following list of numbers represents the banana slug speed measurements for banana slugs moving across linoleum obtained by Bobby from question 1). Use these data to answer the following questions.

Banana Slug Speeds $(\frac{m}{100s})$

0.29 0.91 0.57 0.32 8.72 1.82

(1) a) Calculate the mean of these data.

$2.105 \pm \epsilon \quad \epsilon \leq 0.1$

(2) b) Calculate the median of these data.

$0.74 \pm \epsilon \quad \epsilon \leq 0.01$

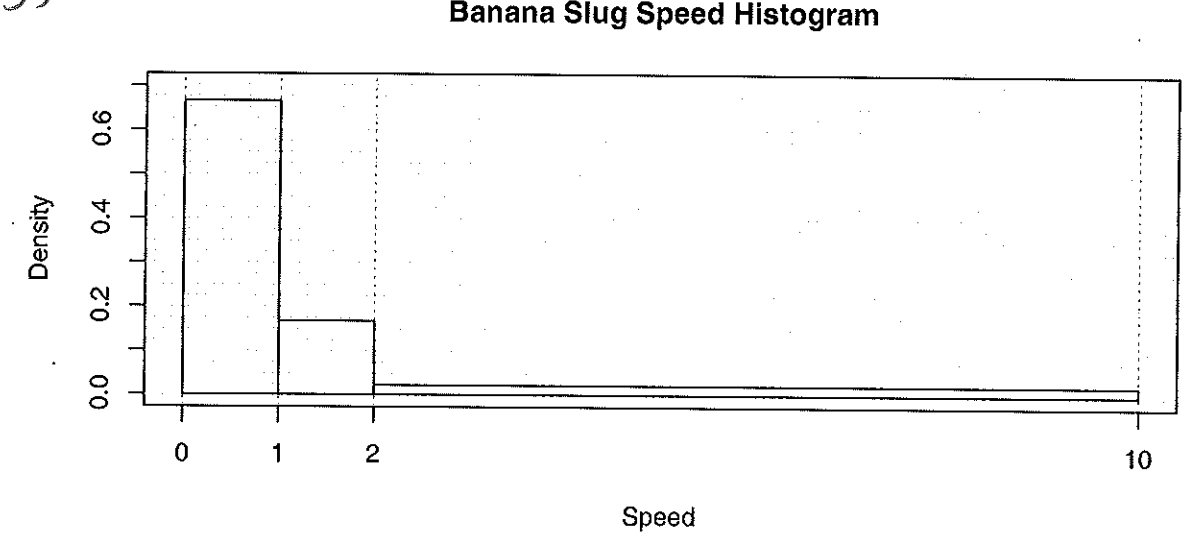
(2) c) Calculate the standard deviation of these data.

$3.29 \pm \epsilon \quad \epsilon \leq 0.2$

(2) d) Are these data skewed? If so what kind of skew? How can you tell?

Mean > Median $\Rightarrow$ Right Skew

(5) e) Construct a histogram of these data using the following classes: [0, 1), [1, 2), [2, 10).



AMS 5 **Midterm** Fall 2015

Name: Key Section: _____ Score: (14)

3), 1) For the following questions consider a traditional deck of cards. Recall that a deck of cards contains 52 total cards, with 13 cards (i.e. ace, 2-10, jack, queen, king) in each of four suits. For each of the following problems consider face cards (i.e. jacks, queens, and kings) as 10's and aces as 1's.

(2) a) Considering aces as 1's and face cards as 10's, construct a box model for the numeric values of cards in a complete deck of cards. (i.e. ignore color and suit; just consider the numeric values of the cards).

$n_{box}=52$

[1] ×4 [2] ×4 [3] ×4 [4] ×4 [5] ×4 [6] ×4 [7] ×4 [8] ×4 [9] ×4 [10] ×16

b) What is the Expected Value for a single draw from the box model of a deck of cards?

(2) $EV_1 \doteq 6.54 \pm \epsilon; \epsilon \leq 0.1$

(2) c) What is the Expected Value for the sum of 100 draws, with replacement, from the box model of a deck of cards?

$$EV_n = n\,EV_1 \doteq 100(6.54) \doteq 653.85 \pm \epsilon; \epsilon \leq 10$$

d) What is the Standard Error for the sum of 100 draws, with replacement, from the box model of a deck of cards?

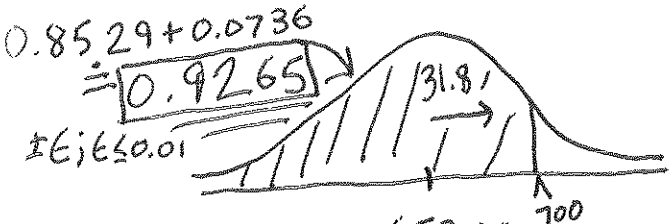
(3) $SD_{box} \doteq 3.18 \pm \epsilon; \epsilon \leq 0.2$

$$SE_{100} \doteq \sqrt{100}\, SD_{box} = 10(3.18 \pm \epsilon) = 31.8 \pm \xi; \xi \leq 2$$

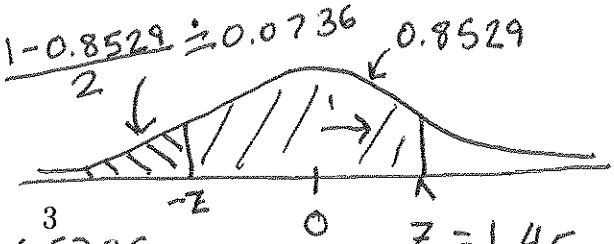
(5) e) What is the probability that the sum of 100 draws, with replacement, from the box model of a deck of cards, will be less than 700?

$$\sum_{i=1}^{100} x_i \sim N(EV_n, SE_n) = N(653.85, 31.8)$$

$0.8529 + 0.0736 \doteq \boxed{0.9265}$ $\pm\epsilon; \epsilon \leq 0.01$



$\frac{1-0.8529}{2} \doteq 0.0736$



$$z = \frac{700 - 653.85}{31.8} \doteq 1.45$$

$z = 1.45$

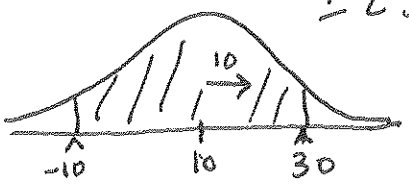
AMS 5 **Midterm** Fall 2015

Name: Key Section: _____ Score: (10)

4), 2) In all of the following questions assume that x is distributed normally with the given means (μ) and standard deviations (σ). (i.e. $x \sim N(\mu, \sigma)$)

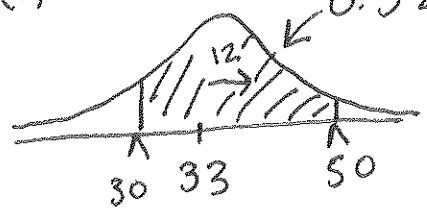
a) Mean: 10, SD: 10; Find the probability that x is between -10 and 30.

(2) ± 2 SDs $\Rightarrow$ 95.45% $\approx$ 95%



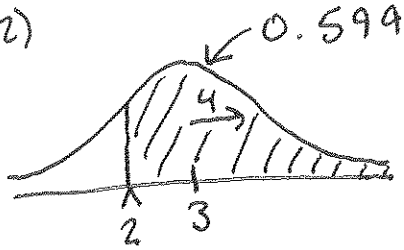
b) Mean: 33, SD: 12; Find the probability that x is between 30 and 50.

(2)



c) Mean: 3, SD: 4; Find the probability that x is greater than 2.

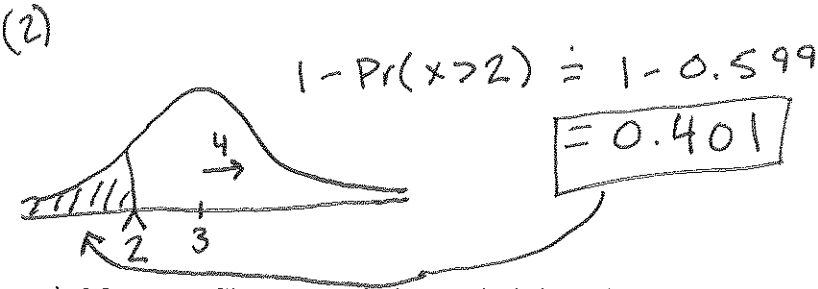
(2)



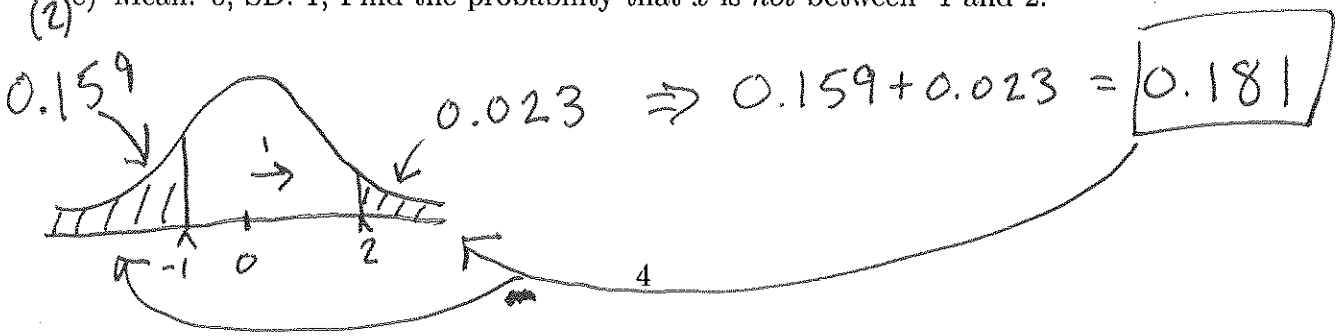
Students should Find Z scores and Values from attached Tables

* d) Mean: 3, SD: 4; Find the probability that x is *not* greater than 2.

(2)



(2) e) Mean: 0, SD: 1; Find the probability that x is *not* between -1 and 2.



AMS 5 **Midterm** Fall 2015

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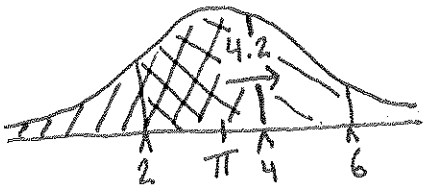
Extra Credit) a) Assume $x \sim N(\mu = 3.1415,\ \sigma = 4.2)$. Find $Pr\Big(\{x \text{ is between 2 and 6}\}$ *or* $\{x \text{ is less than 4}\}\Big)$. That's a logical *or*. You don't get to choose which you'd rather calculate.

(5)



$Pr(x \in (2,6) \text{ or } x < 4) =$

$(2,4);(4,6)$ $(2,4);x<2$ $(2,4)$

$Pr(x \in (2,6)) + Pr(x < 4) - Pr(x \in (2,4))$

*or simply

$=$

$Pr(x < 6) = Pr(x \in (2,4)) + Pr(x \in (4,6)) + Pr(x < 2)$

$\doteq 0.752$

(5) b) In 5 independent fair coins flips what is the probability of *not* receiving at least 1 heads?

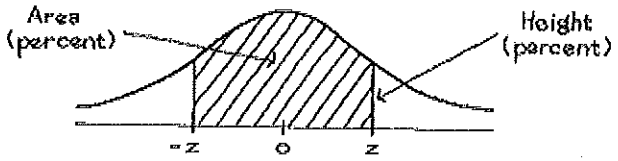
$Pr(\text{Heads}) = 1/2$

$Pr(\text{Not at least 1}) = 1 - Pr(\text{at least 1}) = 1 - Pr(\text{Not None})$

$= 1 - (1 - Pr(\text{None})) = 1 - 1 + Pr(\text{None}) = Pr(\text{None})$

$Pr(\text{None}) = \left(\frac{1}{2}\right)^5 = 0.03125$

Tables



A NORMAL TABLE

z	Height	Area	z	Height	Area	z	Height	Area
0.00	39.89	0	1.50	12.95	86.64	3.00	0.443	99.730
0.05	39.84	3.99	1.55	12.00	87.89	3.05	0.381	99.771
0.10	39.69	7.97	1.60	11.09	89.04	3.10	0.327	99.806
0.15	39.45	11.92	1.65	10.23	90.11	3.15	0.279	99.837
0.20	39.10	15.85	1.70	9.40	91.09	3.20	0.238	99.863
0.25	38.67	19.74	1.75	8.63	91.99	3.25	0.203	99.885
0.30	38.14	23.58	1.80	7.90	92.81	3.30	0.172	99.903
0.35	37.52	27.37	1.85	7.21	93.57	3.35	0.146	99.919
0.40	36.83	31.08	1.90	6.56	94.26	3.40	0.123	99.933
0.45	36.05	34.73	1.95	5.96	94.88	3.45	0.104	99.944
0.50	35.21	38.29	2.00	5.40	95.45	3.50	0.087	99.953
0.55	34.29	41.77	2.05	4.88	95.96	3.55	0.073	99.961
0.60	33.32	45.15	2.10	4.40	96.43	3.60	0.061	99.968
0.65	32.30	48.43	2.15	3.96	96.84	3.65	0.051	99.974
0.70	31.23	51.61	2.20	3.55	97.22	3.70	0.042	99.978
0.75	30.11	54.67	2.25	3.17	97.56	3.75	0.035	99.982
0.80	28.97	57.63	2.30	2.83	97.86	3.80	0.029	99.986
0.85	27.80	60.47	2.35	2.52	98.12	3.85	0.024	99.988
0.90	26.61	63.19	2.40	2.24	98.36	3.90	0.020	99.990
0.95	25.41	65.79	2.45	1.98	98.57	3.95	0.016	99.992
1.00	24.20	68.27	2.50	1.75	98.76	4.00	0.013	99.9937
1.05	22.99	70.63	2.55	1.54	98.92	4.05	0.011	99.9949
1.10	21.79	72.87	2.60	1.36	99.07	4.10	0.009	99.9959
1.15	20.59	74.99	2.65	1.19	99.20	4.15	0.007	99.9967
1.20	19.42	76.99	2.70	1.04	99.31	4.20	0.006	99.9973
1.25	18.26	78.87	2.75	0.91	99.40	4.25	0.005	99.9979
1.30	17.14	80.64	2.80	0.79	99.49	4.30	0.004	99.9983
1.35	16.04	82.30	2.85	9.69	99.56	4.35	0.003	99.9986
1.40	14.97	83.85	2.90	0.60	99.63	4.40	0.002	99.9989
1.45	13.94	85.29	2.95	0.51	99.68	4.45	0.002	99.9991