Name: Section:

STAT 113 – Midterm 2

1a. [1pt] Suppose y is a normally distributed random variable with mean 0 and variance 1.0, i.e. y is standard normal. Find $P(-1.0 < y < 0.5)$.

1b. [2pt] Suppose y is normally distributed random variable with mean 10 and variance 2^2, i.e., $y \sim N(0, 2^2)$. Find the value y_0, such that $P(y > y_0) = 0.1$.

1c. [2pt] Assume x and y are independent random variables with
$E(x) = 1.0$, $E(y) = 10.0$ and $Var(x) = 1.0$, $Var(y) = 4.0$. Let $z = 2x - y$.
Find $E(z)$ and $Var(z)$.

1d. [1pt] Suppose x is a χ^2 distributed random variable with $\nu = 10$ degress of freedom. Find the value x_0, such that $P(x > x_0) = 0.100$.

1e. [4pt] A chromosome mutation believed to be linked with color blindness is knwon to occur, on the average, once in every 10,000 births. If 20,000 babies are born this year in a certain city, using the Poisson approximation to the Binomial distribution find the probabilty that exactly three of the children have the mutation.

2. Let c be a constant and consider the density function

$$f(y) = \begin{cases} (1/c)e^{-y/2} & \text{if } y \geq 0 \\ (1/c)e^{y/2} & \text{if } y < 0 \end{cases}$$

2a. [4pt] Find the value of c.

2b. [3pt] Find the cumulative distribution function $F(y)$.
Hint: Consider two cases: $y < 0$ and $y \geq 0$.

2c. [1pt] Compute $F(1)$.

2d. [1pt] Find $P(y > 0.5)$.

2e. [1pt] Find $P(y > 0.5 | y > 0)$.

3. This year a large architectural and engineering consulting firm began a program of compensating its management personnel for sick days not used. The firm decided to pay each manager a bonus for every unused sick day. In past years, the number y of sick days used per manager per year had a probability distribution with mean $\mu = 9.2$ and variance $\sigma^2 = 4.0$. To determine whether the compensation program has effectively reduced the mean number of sick days used, the firm randomly sampled $n = 100$ managers and recorded y_i, the number of sick days used by each at year's end.

3a. [2pt] Denote with $\bar{y} = \frac{1}{n}\sum_{i=1}^{n} y_i$ the sample mean. Find $E(\bar{y})$ and $Var(\bar{y})$.

3b. [4pt] Find a values c, such that $P(\bar{y} - c < \mu < \bar{y} + c) = 0.95$.

3c. [4pt] Assuming the compensation program was *not* effective in reducing the average number of sick days used, find the probability that $\bar{y}$, the mean number of sick days used by the sample of 100 managers, is leass than 8.80 days, i.e., find $P(\bar{y} < 8.80)$.

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STAT 113 – Midterm 2
Problem 4

Take home problem. Tear this page off the exam, and submit by Wednesday 12:50pm. You can either bring it to class and submit it before the lecture, or you can at any time before class stop by my office (219 Old Chemistry). There will be a file pocket on the board left of my office door).
No group work on this problem.

4. Sixty six bulk specimens of Chilean lumpy iron ore were randomly sampled from a shipload of ore, and the percentage of iron in each ore specimen was determined. The data y_i, $i = 1, \ldots, 66$, are shown in the following table

62.66	63.08	62.94	63.37	63.01	63.64	64.34
62.87	63.22	62.38	61.75	62.94	64.06	64.06
63.22	63.22	61.82	63.29	63.08	62.73	62.87
63.01	63.08	63.01	62.38	63.43	62.52	63.50
62.10	62.87	63.01	62.59	62.24	62.10	63.78
63.43	61.68	62.80	63.92	63.43	63.29	62.10
63.22	62.45	62.80	63.29	62.87	63.01	
63.57	62.10	63.01	63.57	63.64	63.36	
61.75	62.87	62.10	62.80	63.92	63.08	
63.15	62.87	63.29	62.31	63.71	62.03	

The data are available on the WWW at:

`http://www.stat.duke.edu/~pm/113/exams/iron.data`

Or copy the data set by typing from your acpub account:

```
cp /afs/acpub/project/sta215/iron.data iron.data
```

4a. [2pt] Using MINITAB (or any other statistics program of your choice) construct a relative frequency histogram for the data (*cut and paste the printout here*).

4b. [2pt] Find sample mean $\bar{y}$ and sample variance s^2.

4c. [3pt] Let $\mu = E(y_i)$ and $\sigma^2 = Var(y_i)$ denote expected value and variance of the measurements. What is the sampling distribution of the statistic $\frac{\bar{y}-\mu}{s/\sqrt{n}}$?

4d. [3pt] Find a value c, such that $P(\bar{y} - c < \mu < \bar{y} + c) = 0.95$.