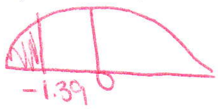
MATH201 STATISTICS I 100pts TEST 3 Fall 2011
page 1 (Part I)

INSTRUCTOR: C.MORRIS
NAME: Key

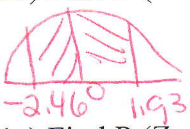
In problem 1 use the Normal Distribution to answer

5pts 1a) Find P (Z < -1.39)



$$\begin{array}{r} .5000 \\ -.4177 \\ \hline \boxed{.0823} \end{array}$$

5pts 1b) Find P (-2.46 ≤ Z ≤ 1.93)



$$\begin{array}{r} .4931 \\ .4732 \\ \hline \end{array}$$

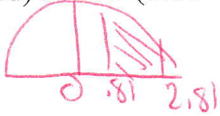
$\boxed{.9663}$

5pts 1c) Find P (Z > -1.17)

$$\begin{array}{r} .5000 \\ +.3790 \end{array}$$

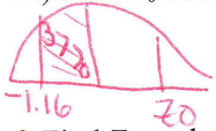
$\boxed{.8790}$

5pts 1d) Find P (0.81 < Z < 2.81)



$$\begin{array}{r} .4975 \\ .2910 \\ \boxed{.2065} \end{array}$$

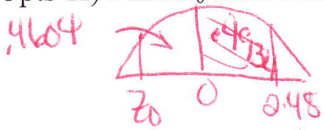
5pts 1e) Find Z_0 such that P (-1.16 < Z < Z_0) = 0.7345



$$\begin{array}{r} .7345 \\ -.3770 \\ \hline .3575 \end{array}$$

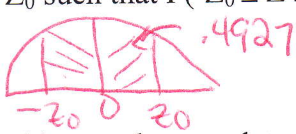
$\boxed{Z_0 \approx 1.07}$

5pts 1f) Find Z_0 such that P(Z_0 ≤ Z ≤ 2.48) = 0.9538



$\boxed{Z_0 \approx -1.76}$

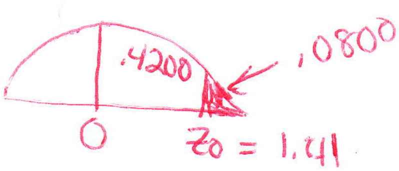
5pts 1g) Find Z_0 such that P(-Z_0 ≤ Z ≤ Z_0) = 0.9854



$\boxed{Z_0 = 2.44}$

10pts 2. A machine used to regulate the amount of sugar dispensed to make a new soda can be set so that it dispenses μ grams on the average, of sugar per liter of soda. The amount of sugar dispensed is Normally distributed with a standard deviation 0.50. If more than 12.5 grams of sugar is dispensed to make a liter of soda it will be considered too sweet (unacceptable). Determine the setting of μ so that no more than 8% of the sodas are unacceptable.

$\sigma = .50$
$\mu = ?$



$$1.41 = \frac{12.5 - \mu}{.5}$$

$$.705 = 12.5 - \mu$$
$$\mu = 12.5 - .705$$
$$\boxed{\mu = 11.795g}$$

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10pts 3. To check the effectiveness of a new production process 2,000 photoflash devices were randomly selected from a very large(infinite) number that had been produced. If the process produces 6% defectives answer the following.

a) Show that it is appropriate to approximate the probability of x (the number of defectives) with a normal distribution.

$p = .06$
$q = .94$
$n = 2000$

$(.06)2000 \pm 3\sqrt{(2000)(.06)(.94)}$ lies within $(0, 2000)$

$120 \pm 3(10.621)$

120 ± 31.86 lies within $(0, 2000)$ ✓ so it is appropriate

b) Find the approximate probability that the number of defectives is between 110 and 138 inclusively.

$P(110 \le x \le 138)$

$P(109.5 \le x_a \le 138.5)$

$P\left(\frac{109.5-120}{10.621} \le z_a \le \frac{138.5-120}{10.621}\right)$

$P(-.99 \le z_a \le 1.74)$

$.3389$
$.4591$
$\boxed{.7980}$

4. Due to the increased marketing and supply costs a bakery has decided to reduce the maximum thickness of its rolled piecrust dough to approximately 0.25 inch. However, the pie crust roller used by the bakery, rolls a random thickness of 0.20 to 0.30 inch. Let x = the thickness of the rolled dough and assume a uniform distribution.

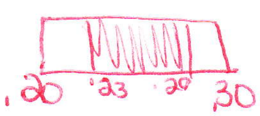
3pts a) Find f (x)

$\frac{1}{.3-.2} = \boxed{10}$

4pts b) Find the mean thickness and standard deviation for the rolled dough.

$\mu = \frac{.20+.30}{2} = \boxed{.25}$ $\sigma = \frac{d-c}{\sqrt{12}} = \frac{.10}{\sqrt{12}} = \boxed{.029}$

3pts c) Find P(0.23 < x < 0.29)



$\frac{.29-.23}{.10} = 6/10 = \boxed{.6000}$

4pts d) Find **a** so P(0.21 < x < **a**) = 0.60

$\frac{a-.21}{.10} = .60$

$a - .21 = .06$

$\boxed{a = .27}$

	$\bar{x}$	m
6,6,6	6	6
6,6,12	8	6
6,6,18	10	6
6,12,6	8	6
6,12,12	10	12
6,12,18	12	12
6,18,6	10	6
6,18,12	12	12
6,18,18	14	18
12,6,6	8	6
12,6,12	10	12
12,6,18	12	12
12,12,6	10	12
12,12,12	12	12
12,12,18	14	12
12,18,6	12	12
12,18,12	14	12
12,18,18	16	18

	$\bar{x}$	m
18,6,6	10	6
18,6,12	12	12
18,6,18	14	18
18,12,6	12	12
18,12,12	14	12
18,12,18	16	18
18,18,6	14	18
18,18,12	16	18
18,18,18	18	18

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5pts 5. Suppose x has an exponential distribution with θ = 2.2 find the following probability $P(x \geq 1.45)$

$\mu = 2.2$

$P(x \geq 1.45) = e^{-1.45/2.2} = \boxed{.5173}$

8pts 6. Suppose the time a customer will wait in line at PNC bank is exponentially distributed with mean 4.0 minutes .What is the probability that a customer would be in line at most 5 minutes?

$\mu = 4.0$
$\theta = 4.0$

$P(x \leq 5) = 1 - P(x > 5)$

$1 - e^{-5/4} = \boxed{.7135}$

5pts 7. A random sample of n = 225 observations is to be drawn from a large population with mean 600 and variance 100. Give the mean and standard deviation of the repeated sampling distribution of $\bar{x}$.

$\mu = 600$ $\quad \mu_{\bar{x}} = 600$

$\sigma = 10$ $\quad \sigma_{\bar{x}} = 10/\sqrt{225} = 2/3$

8pts 8.Consider a population consisting of the measurements 6, 12, 18 and described by the following probability distribution.

x	6	12	18
p(x)	1/3	1/3	1/3

a random sample of n = 3 measurements is selected from the population.

a) Find the sampling distribution of the sample mean, $\bar{x}$. See back page 2

$\bar{x}$	6	8	10	12	14	16	18
$p(\bar{x})$	1/27	3/27	6/27	7/27	6/27	3/27	1/27

b) Determine whether or not the sample median, m, is an unbiased estimator of μ in this situation. [Be careful here you need a different table than part a of this problem]

m	6	12	18
P(m)	7/27	13/27	7/27

$E(x) = \underline{\mu} = 6(\tfrac{1}{3}) + 12(\tfrac{1}{3}) + 18(\tfrac{1}{3})$

$2 + 4 + 6$

$= \underline{12}$

$\underline{E(m)} = 6(7/27) + 12(13/27) + 18(7/27)$

$= \frac{324}{27} = \underline{12}$

unbiased since
$\mu = E(x) = E(m)$
$\boxed{\mu = E(m)}$

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5pts 9. A local bank reported to the federal government that 6,144 savings accounts have a mean balance of $7,500 and a standard deviation of $390. Government auditors have asked to randomly select 169 of the bank accounts in order to assess the reliability of the mean balance reported by the bank. The auditors say they will certify the bank's report only if the sample mean balance is within $60 of the reported mean balance. What is the probability the auditors will certify the bank's report?(use the sampling distribution formulas here)

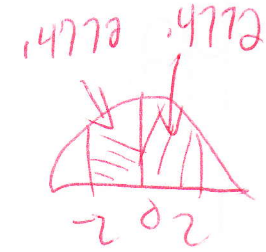
$\mu = 7500$
$\sigma = 390$

$\mu_{\bar{x}} = 7500$
$\sigma_{\bar{x}} = \frac{390}{\sqrt{169}} = 30$

$P(7440 < \bar{x} < 7560)$

$P\left(\frac{7440-7500}{30} \le z_{\bar{x}} \le \frac{7560-7500}{30}\right)$

$P(-2 \le z_x \le 2)$



$2(.4772)$

$\boxed{.9544}$