MATH 408 – QUIZ 2 **NAME:** TOT = 55
PROFESSOR DULIN **SECTION B; NOVEMBER 3, 2004 @ 1:20**

(POINTS) **SHOW YOUR WORK/STEPS! JUTIFY YOUR ANSWERS!**
SUBJECT TO CLASS REMARKS ON USE OF CALCULATORS.

10:17
10:21
-:26

(10) 1. Suppose customers arrive at a certain checkout counter at the rate of two every minute.

(a) If a clerk takes a clerk three minutes to serve the first customer, what is the probability that at least one more customer is waiting when service to the first customer is completed?

MEAN COUNT = $\lambda = 2$ TIME ~ EXPONENTIAL

$$E(T) = \frac{1}{\lambda} = \frac{1}{2}$$

$$P(T<3) = 1 - e^{-2\cdot 3} = 1 - e^{-6} = 0.997521$$

(b) What is the probability that there is only one customer waiting then?

COUNT ~ POISSON

$$P(X=1) = \frac{2^1}{1!} e^{-2} = 2e^{-2} = 0.270671$$

(15) 2. A large construction firm generally wins 60% of the contracts for which it bids. Suppose this firm bids on 25 contracts next month. What is the probability the firm wins at least 12 but less than 18 of these contracts?

(a) Answer using the Binomial table. (Exact.)

$$P(12 \le X < 18) = F(17) - F(11) = 0.846 - 0.078 = 0.768$$

EXCLUDE 18; INCLUDE 12 => EXCLUDE BELOW 12

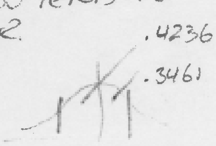
(b) Answer using the Normal approximation.

$$\mu = np = 25(.6) = 15 \quad \sigma^2 = npq = 15(.4) = 6 \quad \sigma = \sqrt{6} = 2.44949$$

$$P(12 \le X < 18) \approx P\left(\frac{11.5-15}{2.44949} < Z < \frac{17.5-15}{2.44949}\right)$$

$$\approx P(-1.43 < Z < 1.02) = .4236 + .3461 = 0.7697$$

I DID NOT DRAW BARS UNDER BELL BUT IF YOU TEND TO FORGET COR. FACTOR THAT MIGHT REALLY HELP



(c) Is the Normal approximation officially acceptable in this situation or not?

$$\left(.6 - 2\sqrt{\frac{.6(.4)}{25}},\ .6 + 2\sqrt{\frac{.6(.4)}{25}}\right) = (.40, .80) \subseteq (0,1) \checkmark$$

IT IS.

REMEMBER CONSTANT REPETITION OF "REMEMBER CORRECTION FACTOR" AT TIME OF 2.5 PRESENTATION

(10) 3. A certain type of resistor is marketed with the specification that the variance is around 50Ω. For a random sample of 25 of these resistors,

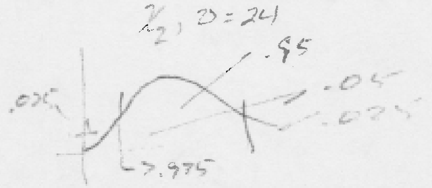
(a) find the probability that $s^2 < 20$.

$$P(s^2 < 20) = P\left(\frac{24 s^2}{50} < \frac{24(20)}{50} = 9.6\right)$$

$\approx .005$

(b) find an interval in which at least 95% of such sample variances should lie.

$\chi^2_{\alpha/2}, \nu = 24$



χ^2: 12.4011 39.3641

$\frac{24 s^2}{50} = 12.4011$ $\qquad$ $\frac{24 s^2}{50} = 39.3641$

$s^2 = \frac{50(12.4011)}{24}$ $\qquad$ $s^2 = \frac{50(39.3641)}{24}$

$s^2 = 25.8356$ $\qquad$ $s^2 = 82.3641$

(10) 4. As a clue to the amount of organic waste in a lake a count was made of the number of bacteria colonies in 100 milliliters of water. The number of colonies in hundreds for samples from the lake were 93, 140, 8, 120, 3, 120, 33, 70, 91, 61, 7, 100, 19, 98, 110, 23, 14, 94, 57, 9, 66, 53, 28, 76, 58, 9, 73, 49, 37, 92. A real investigator would now have to count the samples and compute $\bar{x}$ and s. For the sake of time n = 30, $\bar{x}$ = 60.37, s = 39.62. Find a 90% confidence interval for μ.

$$P\left(\bar{x} - z_{\alpha/2}\frac{s}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2}\frac{s}{\sqrt{n}}\right) = 1-\alpha$$

$$P\left(60.37 - 1.645\frac{31.62}{\sqrt{30}} < \mu < 60.37 + 1.645\frac{39.62}{\sqrt{30}}\right) = 0.90$$

$$P(48.47 < \mu < 72.27) = 0.90$$

(~~15~~) 10 ~~15~~ LEAVE OUTS! 5. Because we have $n \geq 30$ above we do not have to worry about the normality of X, but if we did and we wanted to test for normality by making a normal plot

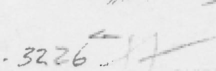
(a) find the z corresponding to x = 28.

1 2 3 4 5 6 7 8 9 10

(sorted list = 3, 7, 8, 9, 9, 14, 19, 23, 28, 33, 37, 49, 53, 57, 58, 61, 66, 70, 73, 76, 91, 92, 93, 94, 98, 100, 110, 120, 120, 140)

why not 9?

$p = \frac{i}{n+1} = \frac{10}{31} = 0.3226$



$.5 - .3226 = 0.1774$

$-0.46 = z$

(b) How would you interpret the result if all of the z's were computed and the plot completed?

WITHIN RANDOMNESS A ST. LINE => NORMAL

OTHERWISE NOT