Name: ID: Serial:

Question1. (2-points) Contamination is a problem in the manufacture of optical storage disks. The number of particles of contamination that occur on an optical disk has a Poisson distribution, and the average number of particles per centimeter squared of media surface is 0.1. The area of a disk under study is 100 squared centimeters. Find the probability that 12 particles occur in the area of a disk under study.

$\lambda = 0.1/cm^2,\ t = 100 \Rightarrow \lambda.t = (100).(0.1) = 10$

$$P(X = 12) = \frac{(10)^{12} e^{-10}}{12!} = 0.0948$$

(2-Points)

Question2. (4-Points) The tensile strength of paper is modeled by a normal distribution with a mean of 35 pounds per square inch and a standard deviation of 2 pounds per square inch.

a.   What is the probability that the strength of a sample is less than 40 lb/inch^2?

$X \sim n(\mu = 35, \sigma = 2)$

$$P(X < 40) = P\left(\frac{X - 35}{2} < \frac{40 - 35}{2}\right)$$

(2-Points)

$$= P(Z < 2.50) = 0.9938$$

b.   If the specifications require the tensile strength to exceed 30 lb/ inch^2, what proportion of the samples is scrapped?

$Scrapped\ if\ (X < 30)$

$$\Rightarrow P(X < 30) = P\left(\frac{X - 35}{2} < \frac{30 - 35}{2}\right)$$

(2-Points)

$$= P(Z < -2.50) = 0.0062$$

The percentage of scrapped = 0.0062*100%=0.62%

Question3. (4-Points) The manufacturing of semiconductor chips produces 2% defective chips. Assume the chips are independent and that a lot contains 1000 chips, then what is the probability that between 20 and 30 chips are defective (exclusive).

$X \sim binomial(n = 1000,\ p = 0.02) \approx n\left(\mu = np = 20, \sigma = \sqrt{npq} = \sqrt{19.6} = 4.4272\right)$

$P(20 < X < 30) = P(21 \le X \le 29)$

(4-Points)

$$\approx P\left(\frac{20.5 - 20}{4.4272} \le \frac{X - 20}{4.4272} < \frac{29.5 - 20}{4.4272}\right)$$

$$= P(0.11 < Z < 2.15) = 0.9842 - 0.5438 = 0.4404$$