

Stat 235

Lab 3

WOOSAREE, Arun

Lab EL12

TA: Jessa Marley

October 22, 2018

1

As λ increases, the distribution shifts to the right, since λ is the mean value of the distribution. We also see that as this distribution shifts to the right, the curve flattens as a result of the mean probability decreasing while the spread increases. Since Poisson distributions measure the number of successes in an interval, and in this case a “success” is a flaw in a plastic panel, we can clearly see that as λ increases, the number of flaws in the plastic panels also increase.

2

2.a

Assuming $\lambda = 0.5$, the probability that there are no flaws in a randomly selected panel is $P(X = 0)$. Using the *Poisson Probabilities* worksheet, we find this number to be 0.6065, or 60.65% of the panels are in perfect condition

2.b

The percentage of panels with 2 or more flaws can be found as shown below:

$$P(X \geq 2) = 1 - P(X < 2) = 1 - P(X \leq 1)$$

Using the *Poisson Probabilities* worksheet, we find $P(X \leq 1) = 0.9098$, so

$$P(X \geq 2) = 1 - 0.9098 = 0.0902$$

So, 9.02% of the panels would need to be scrapped.

2.c

From 2.b, we know the probability of a single panel not being defective is $P(X \leq 1) = 0.9098$. For ten panels,

$$P(X \leq 1)^{10} = 0.9098^{10} = 0.38856110447...$$

Therefore, the probability that a random sample of 10 panels not containing a defective panel is approximately 0.389.

3

From in-class notes, the Central Limit Theorem states the following:

Central Limit Theorem. *When n is sufficiently large, the sampling distribution of \bar{x} is well approximated by a normal curve, even when the population distribution is not itself normal. The Central Limit Theorem can safely be applied if n is at least 30.*

Note: For Question 3, $\lambda = 0.5$

3.a

Referring to the Central Limit Theorem as defined above, we cannot safely assume that the sampling distribution of the average number of flaws in a random sample of 10 panels follows approximately a normal distribution. The Central Limit Theorem states that it can only be safely applied when the sample size is greater than or equal to 30.

If we were to assume that the Central Limit Theorem does apply, however, the probability that the average number of flaws in a random sample of 10 panels does not exceed 0.3 is found as follows:

$$\begin{aligned}\sigma^2 = \lambda &\Rightarrow \sigma = \sqrt{\lambda} = \sqrt{0.5} = \frac{1}{\sqrt{2}} \\ \Rightarrow \sigma_{\bar{x}} &= \frac{\sigma}{\sqrt{n}} = \frac{1/\sqrt{2}}{\sqrt{10}} = \frac{1}{\sqrt{20}} \approx 0.2236\end{aligned}$$

Plugging in λ , and $\sigma_{\bar{x}}$ into the *Normal Probabilities Sheet*, we find that $P(X \leq 0.30) = 0.1855$.

3.b

We can safely assume that the sampling distribution of the average number of flaws in a random sample of 30 panels follows approximately a normal distribution, because a sample size of 30 satisfies the condition in the Central Limit Theorem which requires a sample size greater than or equal to 30.

Assuming that the Central Limit Theorem does apply, the probability that the average number of flaws in a random sample of 30 panels does not exceed 0.3 is found as follows:

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{1/\sqrt{2}}{\sqrt{30}} = \frac{1}{\sqrt{60}} \approx 0.129$$

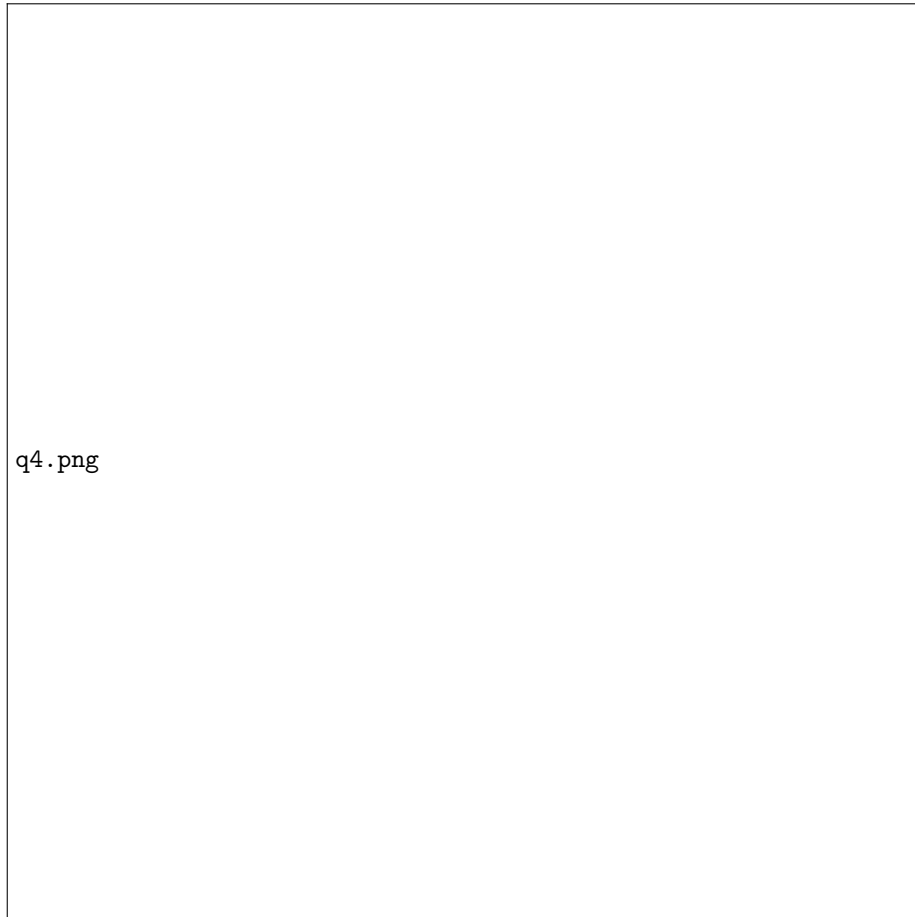
Plugging in λ , and $\sigma_{\bar{x}}$ into the *Normal Probabilities Sheet*, we find that $P(X \leq 0.30) = 0.0607$.

4

4.a

4.b

4.c



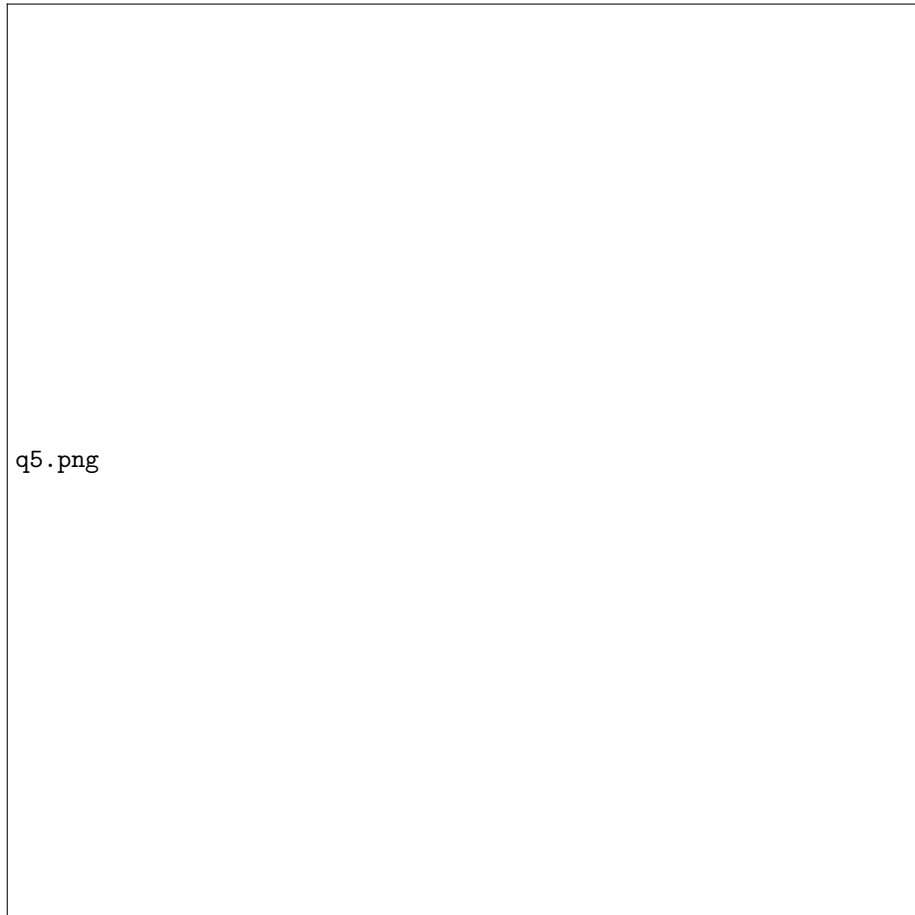
q4.png

Figure 1: INSERT CAPTION HERE

4.d

5

5.a



q5.png

Figure 2: INSERT CAPTION HERE

5.b