P1. As the lambda decreases from 4 to 0.25, the peak (mode) of the function shift leftwards with respect to the x-axis. With the decreasing lambda, the gradient of the function decreases at higher speed as X increases while X > lambda, and the probability is more concentrated around X equals to lambda.

The decrease shows that the probability of request a new test is more concentrated on the expected number (mean) of requests with the decreasing in lambda. And people are more likely and willing to request less new tests.

P2.

1. P(X=0) = **0.0821**
2. P(X>=6) = 1 – P(X<=5) = 1-0.9580 = **0.0420**
3. Binomial: n = 28, x = 0, p = 0.0420

P(X=0) = **0.3008**

1. Binomial: n = 28, x = 2, p = 0.0420

P(X>2) = **0.1115**

1. Geometric:

E = 1 / p = 1/0.0420 = **23.8095**

σ = sqrt[(1-p) / p^2] = sqrt(0.958/0.042^2) = **23.3042**

P3.

1. Poisson: λ = 3.5, x = 0

P(X=0) = 0.0302

Neg. Bin.: r = 1, p = 0.0302, x = 5

P(X=5) = **0.0267**

1. Poisson: λ = 3.5, x = 1

P(X>=1) = 1-0.0302 = 0.9698

P = P(>=1 on day 4) \* P(>=1 on day 5) \* P(>=1 on day 6) \* P(>=1 on day 7) \* P(=0 on day 8) = 0.9698^4\*0.0302 = **0.0267**

1. The result from part (a) and (b) are the same, because the number of drops in previous doesn’t affect that in the future days, each day’s independent with λ unchanged. So, probabilities are the same.

P4.

1. Number of days = **107 days**

Proportion of days = 107/1200 = **0.0892**

In 2(a), probability = 0.0821 which is close but not identical to 0.0892. The values should not be identical since for this question, we randomly generate 1200 days of samples for experiment under the same Poisson distribution, but 1200 samples cannot represent a general probability among all.

1. Number of samples = **55 samples**

Proportion of samples = 55/1200 = **0.0458**

Compared to the result of 2(b), 0.0420 is close but not identical to 0.0458 of this question, the reason is the same as 4(a)

The shape of the distribution is similar to a normal distribution, it is also a unimodal distribution, the number of new test request per day per sample concentrates around 2.5 and decreases while expanding on both sides. It is a unimodal distribution. It is left-skewed.

P5.

1. Number of days = **240 days**

Proportion of days = 107/1200 = **0.0800**

In 2(a), probability = 0.0821 which is close but not identical to 0.0800. The values should not be identical since for this question, we randomly generate 3000 days of samples for experiment under the same Poisson distribution, but 3000 samples cannot represent a general probability among all.

Compared to 4(a), the result is a bit closer to the ideal result calculated from Poisson formula, the reason is as we take more samples and get the result averaged through a larger population of 3000 compared to 1200, the result will act more like the way it is supposed to be.

1. Number of samples = **144 samples**

Proportion of samples = 144/3000 = **0.0480**

Compared to the result of 2(b), 0.0420 is close but not identical to 0.0480 of this question, the reason is the same as 5(a)

The result proportion is close but a little bit larger compared to that in 5(b)

The shape of the function is similar to a normal distribution, it is also a unimodal distribution, compared to 4(c) the number of new test request per day per sample is more concentrated around 2.5~2.75 and decreases while expanding on both sides. It is a unimodal distribution with right-skewed.