Answer – Q1.A

n = 20, p = $\frac{1}{4}$

Answer – Q1.B

To find the probability of 8 or more employees fearing catching COVID-19 at work, we can use this equation : P = $X \geq 8 = \sum_{k=8}^{20} \binom{n}{k} p^k (1 - p)^{n-k}$, and in the R we can use below commands,

```
> prob_less_than_8 <- pbinom(7, size = 20, prob = 0.25, lower.tail = TRUE)
> prob_less_than_8
[1] 0.8981881
> prob_8_or_more <- 1 - prob_less_than_8
> prob_8_or_more
[1] 0.1018119
```

Answer – Q1.C

```
> prob_exactly_4 <- dbinom(4, size = 20, prob = 0.25)
> prob_exactly_4
[1] 0.1896855
```

Answer – Q2.A

```
> prob_X_gt_4 <- 1 - pgamma(4, shape = 2, scale = 3)
> prob_X_gt_4
[1] 0.61506
```

Answer – Q2.B (i)

```
> n = 50000
> samples <- rgamma(n, shape = 2, scale = 3)
> proportion_gt_4 <- sum(samples > 4)/n
> proportion_gt_4
[1] 0.61424
```

Answer – Q2.B (ii)

```
> estimated_mean <- mean(samples)
> estimated_mean
[1] 6.015659
```

Answer – Q3.A

```
> mu <- 9
> standard_deviation <- sqrt(mu)
> standard_deviation
[1] 3
```

Answer – Q3.B

```
> prob_mu_plus_sigma <- ppois(mu + standard_deviation, lambda = mu)
> prob_mu_minus_sigma <- ppois(mu - standard_deviation, lambda = mu)
> prob_within_1_std_dev <- prob_mu_plus_sigma - prob_mu_minus_sigma
> prob_within_1_std_dev
[1] 0.6689926
```

Answer – Q4

The exponential distribution of Y is modified by the transformation $x = \frac{1}{5}Y + 2$ as it incorporates both multiplication and addition. Although Y follows to an exponential distribution with a rate parameter. $\lambda = \frac{1}{5}$ the resulting variable x does not follow an exponential distribution due to the alteration in shape and size induced by the transformation. Generally, linear transformations do not maintain the original distribution of a random variable, and the resulting distribution of x will depend on the specific characteristics of the transformation.

Answer – Q5.A

```
> prob <- pnorm(7, mean = 6.7, sd = 0.6) - pnorm(6.5, mean = 6.7, sd = 0.6)
> prob
[1] 0.3220211
```

Answer – Q5.B

```
> n <- 65
> expected_Y <- prob * n
> expected_Y
[1] 20.93137
```