Assignment 5: Modeling COVID-19

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Exercise 1

```
days_range <- 1:250
```

Exercise 2

```
susceptible <- 300000000
infectious  <- 1
recovered   <- 0
```

Exercise 3

```
beta  <- 0.25
gamma <- 0.125
N     <- 300000001

for(day in 2:250){
  susceptible[day] <- susceptible[day - 1] - (beta  * susceptible[day - 1] * infectious[day - 1
  infectious[day]  <- infectious[day - 1]  + (beta  * susceptible[day - 1] * infectious[day - 1
  recovered[day]   <- recovered[day - 1]   + (gamma * infectious[day - 1])
}
```

Exercise 4

```
library(tibble)

covid_sim <- tibble(
  day         = days_range,
  susceptible = susceptible,
  infectious  = infectious,
```

```
  recovered   = recovered
)
```

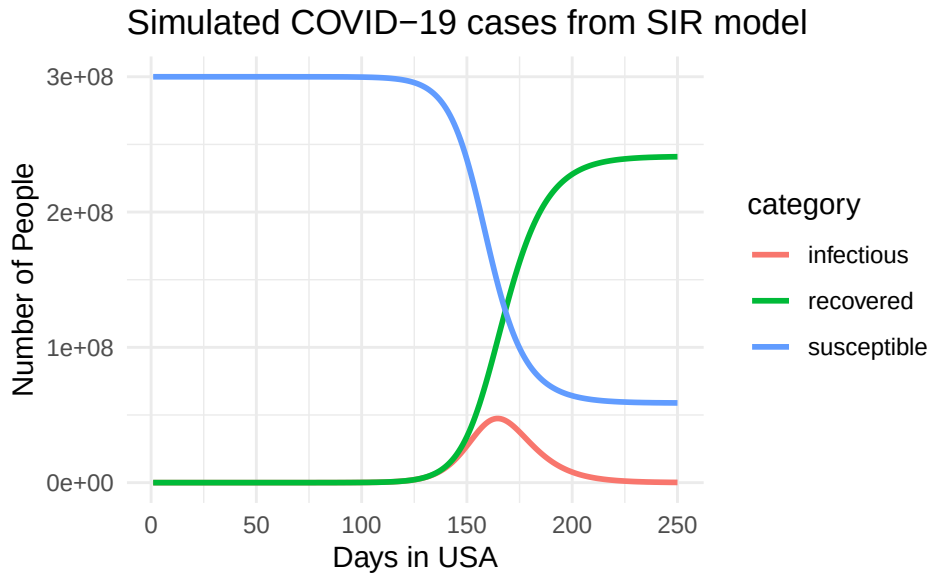
Exercise 5

```
library(ggplot2)
library(tidyr)

covid_long <- covid_sim %>%
  pivot_longer(cols = c(susceptible, infectious, recovered),
               names_to = "category",
               values_to = "count")

ggplot(covid_long, aes(x = day, y = count, color = category)) +
  geom_line(size = 1) +
  labs(
    title = "Simulated COVID-19 cases from SIR model",
    x = "Days in USA",
    y = "Number of People"
  ) +
  theme_minimal()
```

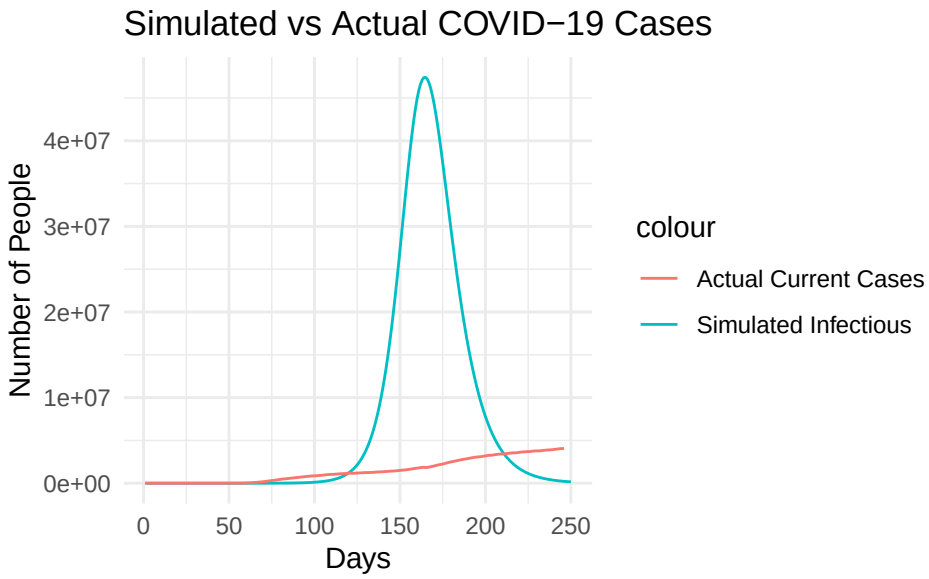
```
## Warning: Using 'size' aesthetic for lines was deprecated in ggplot2 3.4.0.
## i Please use 'linewidth' instead.
## This warning is displayed once every 8 hours.
## Call 'lifecycle::last_lifecycle_warnings()' to see where this warning was
## generated.
```



Exercise 6

```
library(ggplot2)

ggplot() +
  geom_line(data = covid_sim, aes(x = day, y = infectious, color = "Simulated Infectious")) +
  geom_line(data = covid_real, aes(x = days_in_country, y = current_cases, color = "Actual Curr
  labs(
    title = "Simulated vs Actual COVID-19 Cases",
    x = "Days",
    y = "Number of People"
  ) +
  theme_minimal()
```

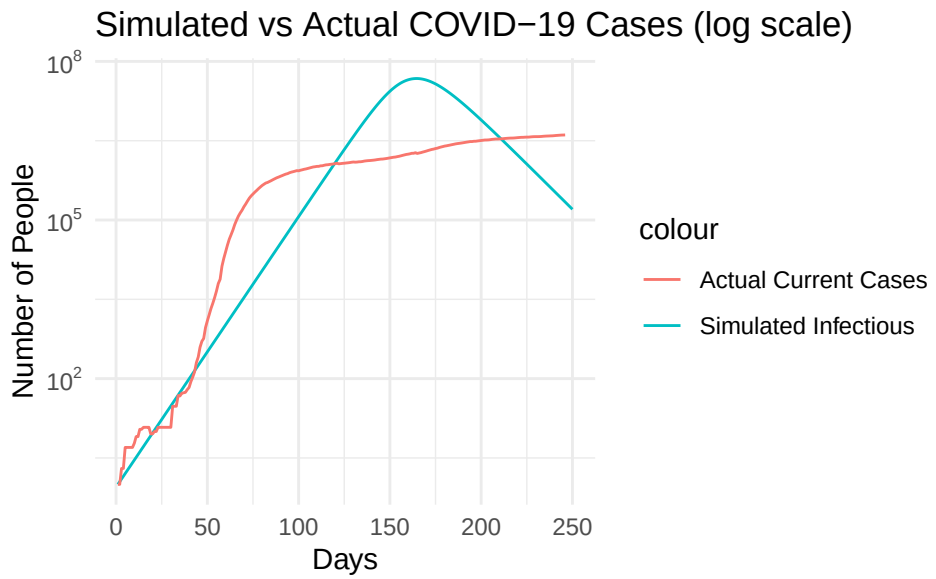


Exercise 7

```
library(ggplot2)
library(scales)

ggplot() +
  geom_line(data = covid_sim, aes(x = day, y = infectious, color = "Simulated Infectious")) +
  geom_line(data = covid_real, aes(x = days_in_country, y = current_cases, color = "Actual Curr
  labs(
    title = "Simulated vs Actual COVID-19 Cases (log scale)",
    x = "Days",
    y = "Number of People"
  ) +
```

```
  theme_minimal() +
  scale_y_log10(labels = trans_format("log10", math_format(10^.x)))
```



Exercise 8

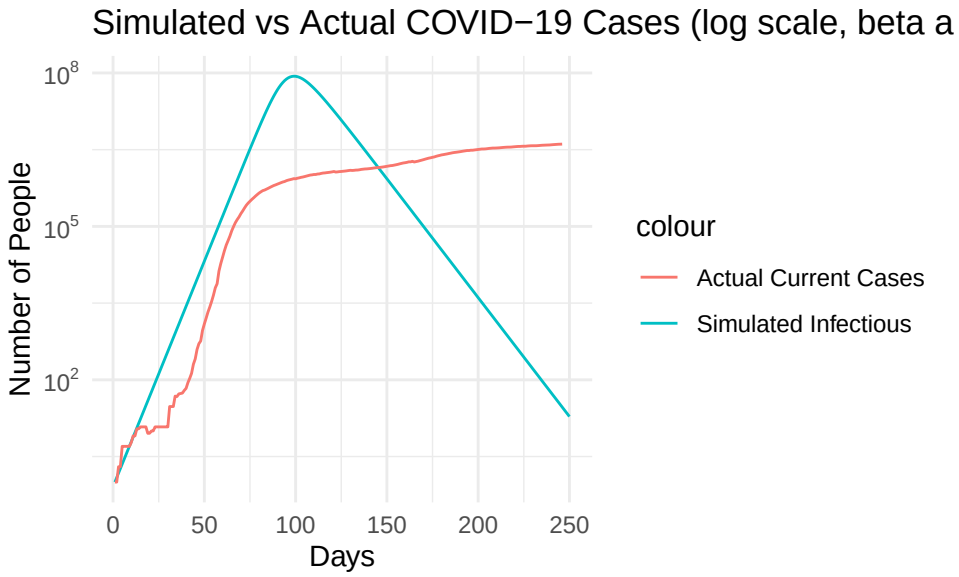
```
days_range   <- 1:250
susceptible  <- 300000000
infectious   <- 1
recovered    <- 0


beta  <- 0.35
gamma <- 0.125
N     <- 300000001

for(day in 2:250){
  susceptible[day] <- susceptible[day - 1] - (beta  * susceptible[day - 1] * infectious[day - 
  infectious[day]  <- infectious[day - 1]  + (beta  * susceptible[day - 1] * infectious[day - 
  recovered[day]   <- recovered[day - 1]   + (gamma * infectious[day - 1])
}

covid_sim <- tibble(
  day         = days_range,
  susceptible = susceptible,
  infectious  = infectious,
  recovered   = recovered
)
```

```r
ggplot() +
  geom_line(data = covid_sim, aes(x = day, y = infectious, color = "Simulated Infectious")) +
  geom_line(data = covid_real, aes(x = days_in_country, y = current_cases, color = "Actual Curr
  labs(
    title = "Simulated vs Actual COVID-19 Cases (log scale, beta adjusted)",
    x = "Days",
    y = "Number of People"
  ) +
  theme_minimal() +
  scale_y_log10(labels = trans_format("log10", math_format(10^.x)))
```



Academic Integrity statement