Assignment 7: 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 * infectious[day - 1] * susceptible[day -
  infectious[day] <- (infectious[day - 1]) + ((beta * infectious[day - 1] * susceptible[day - 1
  recovered[day] <- (recovered[day - 1]) + (gamma*infectious[day - 1])
}
```

Exercise 4

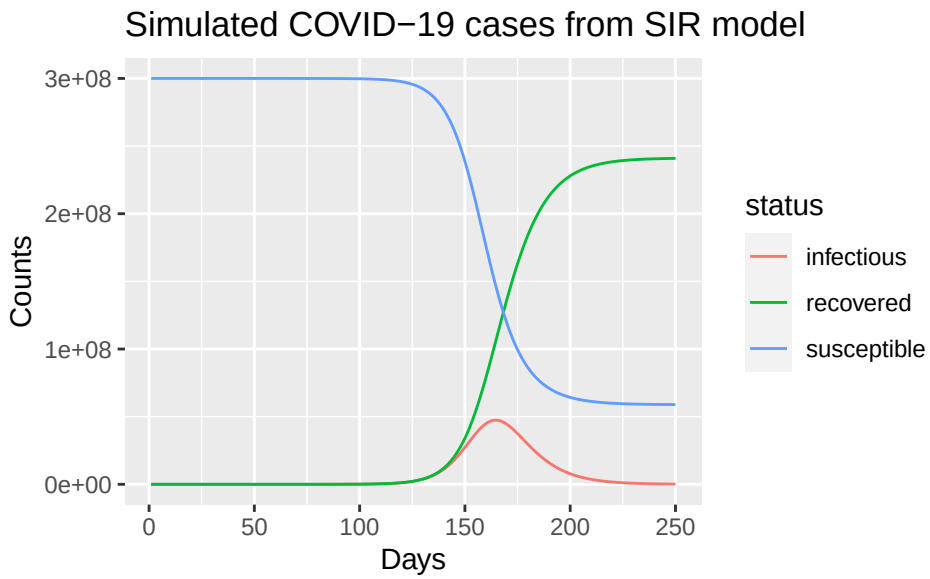
```
covid_sim <- tibble(days_range, susceptible, infectious, recovered)
```

Exercise 5

i.

```
covid_sim <- covid_sim %>%
  gather(
  susceptible:recovered,
  key = "status",
  value = "value"
)
```

```
ggplot(data = covid_sim) +
  geom_line(aes(x = days_range, y = value, color = status)) +
  labs(
    title = "Simulated COVID-19 cases from SIR model",
    x = "Days",
    y = "Counts"
  )
```



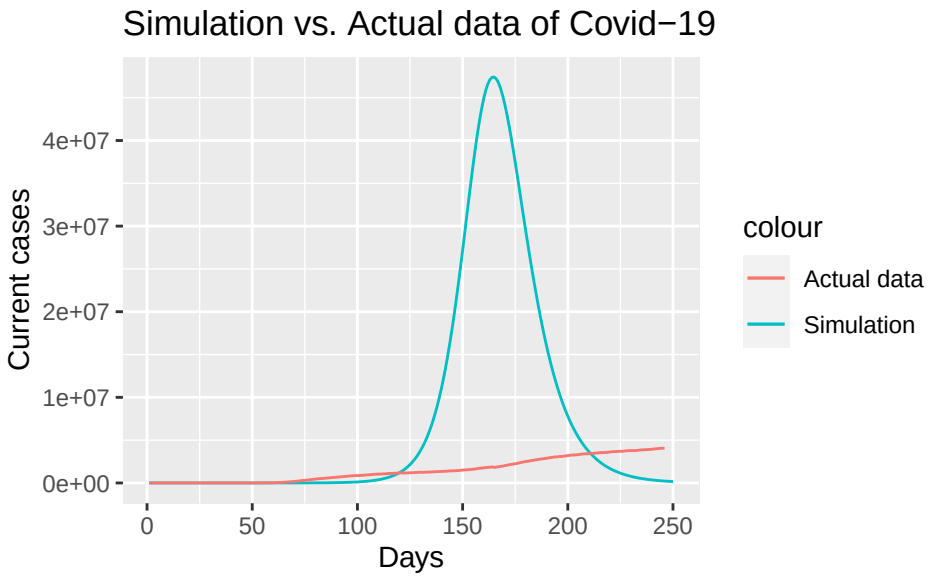
ii. ***Over time, it seems as if the number of infected people increased and then decreased. The number of people of recovered increased and the number of people susceptible decreased. This shows the trend of people who were infected, but later recovered and are no longer susceptible.***

Exercise 6

i.

```
covid_sim_filtered <- covid_sim %>%
  filter(status == 'infectious')
```

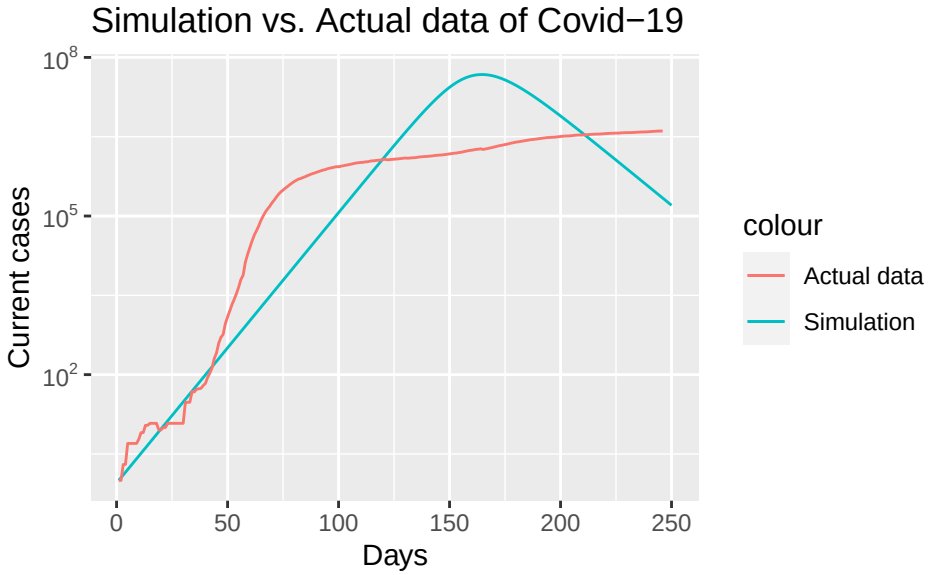
```
ggplot(data = covid_sim_filtered) +
  geom_line(aes(x = days_range, y = value,color = 'Simulation')) +
  geom_line(data = covid_real, aes(x = days_in_country, y = current_cases, color = 'Actual data
  labs(title = 'Simulation vs. Actual data of Covid-19',
       x = 'Days',
       y = 'Current cases'
         )
```



ii. The SIR's model predicted that the cases would quicky spike up and fall back down in a short period of time. On the other hand, the actual data shows that the cases of covid-19 are still increasing slowly over a long period of time.

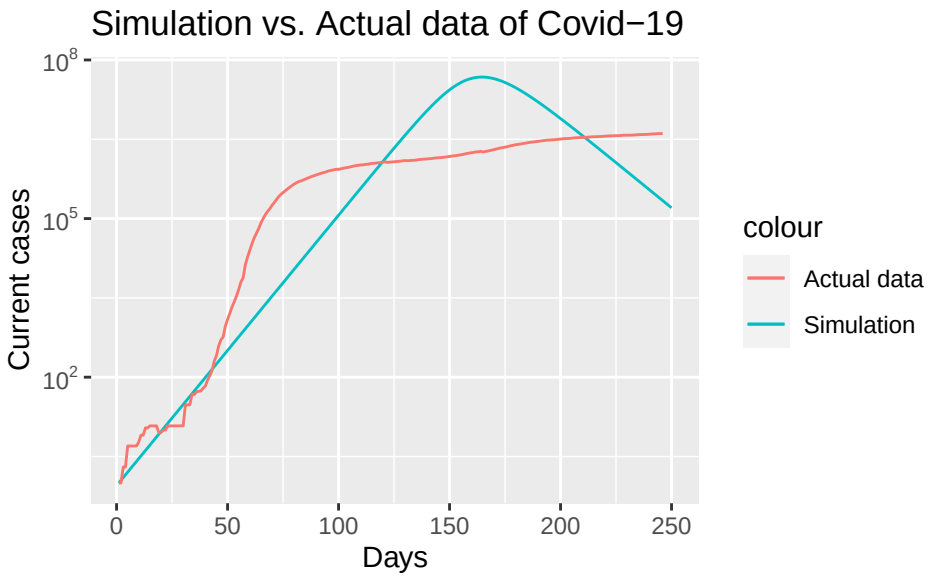
Exercise 7

```
ggplot(data = covid_sim_filtered) +
  geom_line(aes(x = days_range, y = value,color = 'Simulation')) +
  geom_line(data = covid_real, aes(x = days_in_country, y = current_cases, color = 'Actual data
  labs(title = 'Simulation vs. Actual data of Covid-19',
       x = 'Days',
       y = 'Current cases') +
  scale_y_log10(labels=trans_format('log10', math_format(10^.x)))
```



Exercise 8

```
#days
days_range <- 1:250

#status starting values
susceptible <- 300000000
infectious <- 1
recovered <- 0

#beta and gamma values
beta <- 0.25
gamma <- 0.125
N = 300000001

#for loop calculating status values
for(day in 2:250){
  susceptible[day] <- (susceptible[day - 1]) - ((beta * infectious[day - 1] * susceptible[day -
  infectious[day] <- (infectious[day - 1]) + ((beta * infectious[day - 1] * susceptible[day - 1
  recovered[day] <- (recovered[day - 1]) + (gamma*infectious[day - 1])
}
#creating tibble
covid_sim <- tibble(days_range, susceptible, infectious, recovered)

#tidy format
covid_sim <- covid_sim %>%
  gather(
  susceptible:recovered,
  key = "status",
  value = "value")

#filtering infectious status
covid_sim_filtered <- covid_sim %>%
  filter(status == 'infectious')

#plotting results
ggplot(data = covid_sim_filtered) +
  geom_line(aes(x = days_range, y = value,color = 'Simulation')) +
  geom_line(data = covid_real, aes(x = days_in_country, y = current_cases, color = 'Actual data
  labs(title = 'Simulation vs. Actual data of Covid-19',
       x = 'Days',
       y = 'Current cases') +
  scale_y_log10(labels=trans_format('log10', math_format(10^.x)))
```



The reproduction value that made the simulation better fit the actual data that I tried is 2 (beta/gamma -> 0.25/0.125).