Homework 9

Enter your name and EID here

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This homework is due on April 18, 2022 at 11:00pm. Please submit as a pdf file on Canvas.

For all problems in this homework, we will work with the `heart_disease_data` dataset, which is a simplified and recoded version of a dataset available from kaggle. You can read about the original dataset here: https://www.kaggle.com/datasets/kamilpytlak/personal-key-indicators-of-heart-disease?resource=download

The `heart_disease_data` dataset contains 9 variables: `HeartDisease`(whether or not the participant has heart disease), `BMI` (body mass index), `PhysicalHealth` (how many days a month was their physical health not good), `MentalHealth` (how many days a month was their mental health not good), `ApproximateAge` (participants age), `SleepTime` (how many hours of sleep do they get in a 24-hour period), `Smoking` (1-smoker, 0-nonsmoker), `AlcoholDrinking` (1-drinks alcohol, 0-does not drink), `PhysicalActivity` (1-did physical activity or exercise during the past 30 days, 0-hardly any physical activity). Compared to the original dataset, the columns `ApproximateAge`, `Smoking`, `AlcoholDrinking`, and `PhysicalActivity` have been converted into numeric columns so they can be included in a PCA.

Note: This homework is about the contents of the plots. Don't worry about styling. It's OK to use the default theme and plot labeling.

```
heart_data <- read_csv("https://wilkelab.org/SDS375/datasets/heart_disease_data.csv")
```

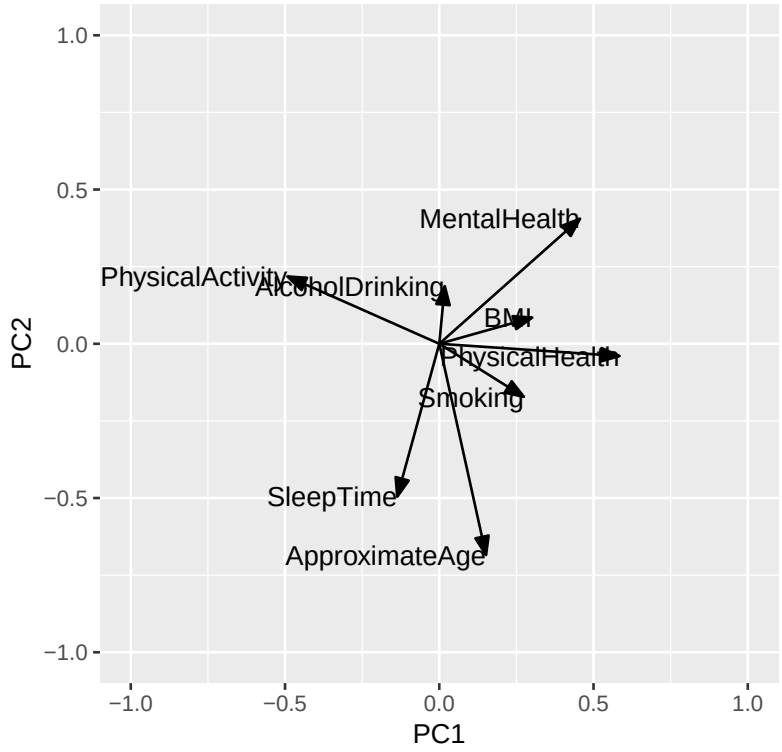
Problem 1: (5 pts)

Perform a PCA of the `heart_disease_data` dataset and make two plots: 1. A rotation plot of components 1 and 2; 2. A plot of the eigenvalues, showing the amount of variance explained by the various components.

```
# performing PCA
pca_fit <-
  heart_data |>
    select(where(is.numeric)) |>
    scale() |>
    prcomp()

# adding pca components back into the dataframe
heart_data_pca <-
  pca_fit |>
    augment(heart_data)
```

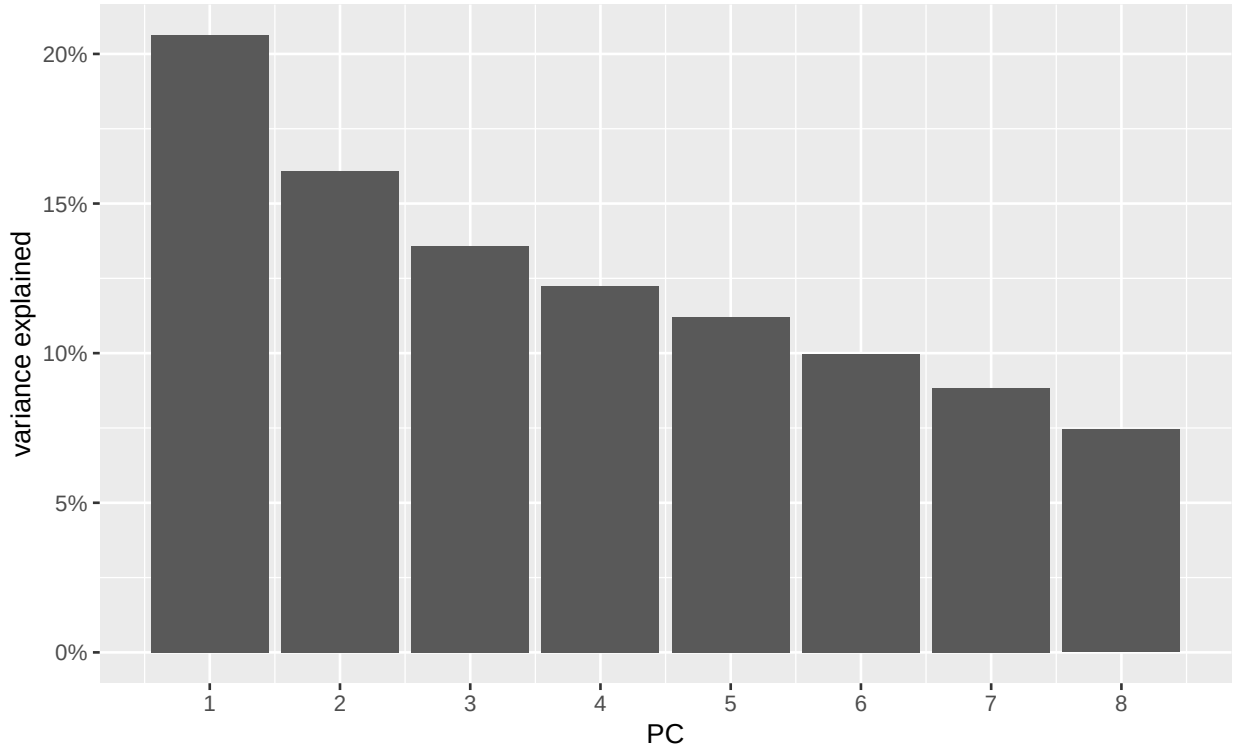
```
# arrow style settings
arrow_style <-
  arrow(
    angle = 20, length = grid::unit(8, "pt"),
    ends = "first", type = "closed"
  )
```

```
# rotation plot of components 1 and 2
pca_fit |>
  tidy(matrix = "rotation") |>
  pivot_wider(
    names_from = "PC", values_from = "value",
    names_prefix = "PC"
  ) |>
  ggplot(aes(PC1, PC2)) +
  geom_segment(
    xend = 0, yend = 0,
    arrow = arrow_style
  ) +
  geom_text(aes(label = column), hjust = 1) +
  xlim(-1, 1) + ylim(-1, 1) +
  coord_fixed()
```



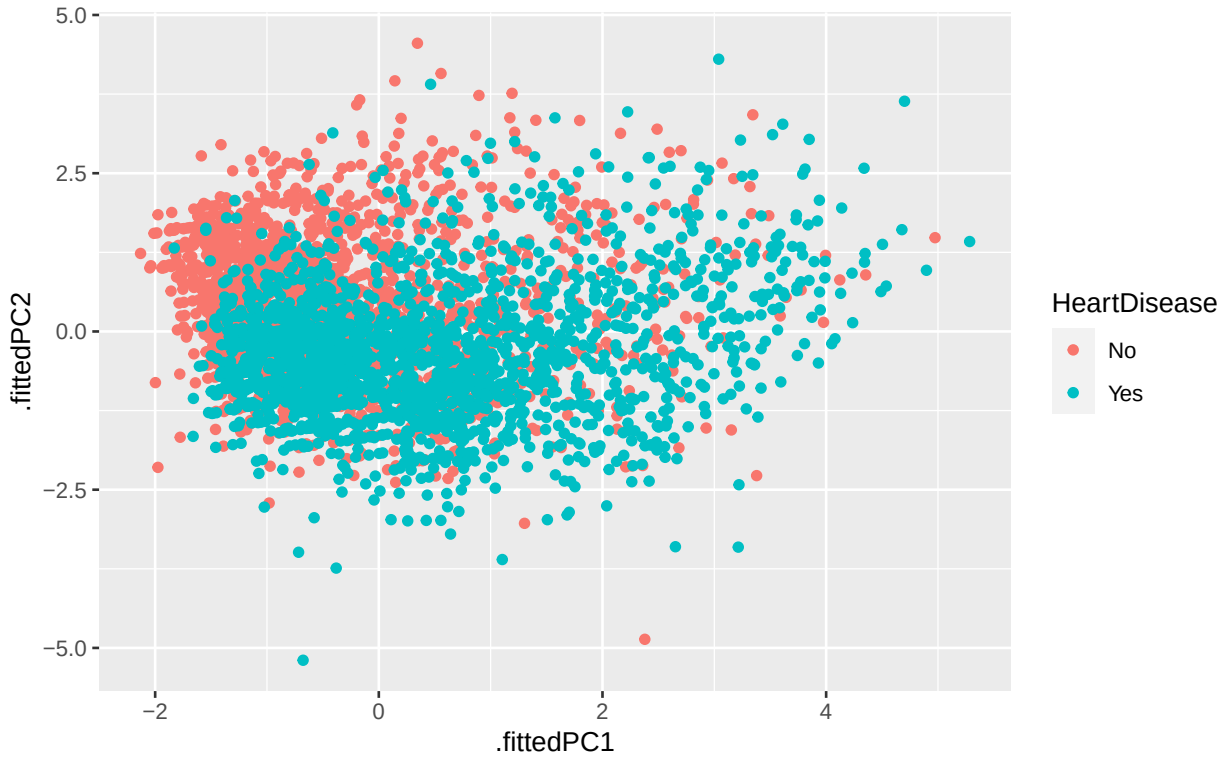

```
# eigenvalue plot

pca_fit |>
  tidy(matrix = "eigenvalues") |>
  ggplot(aes(PC, percent)) +
  geom_col() +
  scale_x_continuous(
    breaks = 1:8
  ) +
  scale_y_continuous(
    name = "variance explained",
```

```
    label = scales::label_percent(accuracy = 1)
  )
```



Problem 2: (5 pts) Make a scatter plot of PC 2 versus PC 1 and color by heart disease status. Then use the rotation plot from Problem 1 to describe the variables/factors by which we can separate the study participants with heart disease from the study participants without heart disease.

```
heart_data_pca |>
  ggplot(
    aes(.fittedPC1, .fittedPC2)
  ) +
  geom_point(aes(color = HeartDisease))
```



People with heart disease and people without heart disease separate mostly along PC 2. People that do not have heart disease tend to have more physical activity in their life, are less likely to smoke, are younger and have less days a month where they do not feel well.