Assignment 7

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2023-11-29

```r
library(pacman)
```

```
## Warning: package 'pacman' was built under R version 4.2.3
```

```r
p_load(tidyverse, ggplot2, forcats, palettes, treemapify)
```

Data Sources

```r
applications <- read.csv("metals_and_applications.csv", stringsAsFactors=F)
applications <- applications %>%
    select(-Source, -Category_Note) %>%
    mutate(Critical.Mineral = toupper(Critical.Mineral)) %>%
    rename(Mineral = Critical.Mineral)

comm_counts <- read.csv("metals_commodity_counts.csv", stringsAsFactors=F)
comm_counts <- comm_counts %>%
  select(-Source) %>%
  mutate(Country = toupper(Country))

imports <- read.csv("metals_net_imports.csv", stringsAsFactors=F)
imports <- imports %>%
    select(-Source) %>%
    rename(Country = Major_Import_Sources_2018_2021, Mineral = Commodity) %>%
    mutate(Mineral = toupper(Mineral), Country = toupper(Country))

allies <- read.csv("united-states-allies-2023.csv", stringsAsFactors=F)
allies <- allies %>%
  select(country, UnitedStatesAllies2023, unMember) %>%
  rename(Country = country, isAlly = UnitedStatesAllies2023) %>%
  mutate(Country = toupper(Country), isAlly = ifelse(is.na(isAlly), "No", "Yes"), unMember = ifelse(unMe
```

Merging and cleaning

Imports – we need to identify whether specific countries

```r
minerals <- full_join(imports, applications, by = "Mineral")

countries <- left_join(comm_counts, allies, by = "Country") %>%
  mutate(isAlly = ifelse(is.na(isAlly), "No", isAlly), unMember = ifelse(is.na(unMember), "No", unMember
```

Graphs

```
countries %>%
  ggplot(aes(x = fct_reorder(Country, Commodity_Count), y = Commodity_Count, fill = isAlly)) +
  geom_col() +
  coord_flip() +
  theme_bw() +
  scale_fill_manual(values = c("goldenrod2", "brown4"), name = "U.S. Ally") +
  ylim(0,30) +
  scale_y_continuous(expand = c(0, 0)) +
  labs(y = "Number of Critical Minerals Imported by the U.S.",
       x = "Country",
       title = "How many critical minerals are imported to the U.S. from \n each country?",
       subtitle = "Highest number of mineral imports come from China, Canada, and Germany.") +
  theme(axis.text.y = element_text(size=6))
```

How many minerals are produced by each of the countries and are they an ally?

```
## Scale for y is already present.
## Adding another scale for y, which will replace the existing scale.
```
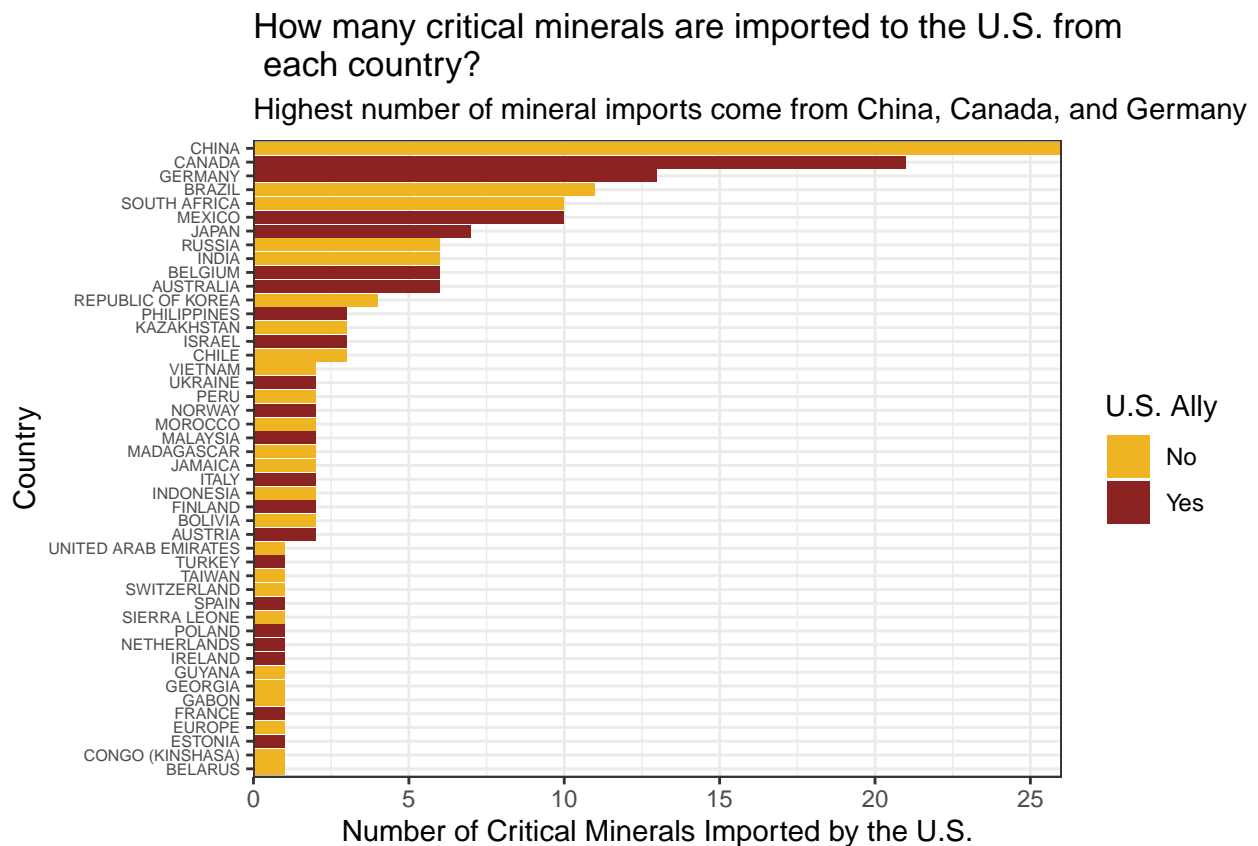
```
countries %>%
  group_by(isAlly) %>%
  summarize(total = sum(Commodity_Count)) %>%
  ggplot(aes(x = isAlly, y = total, fill = isAlly)) +
  geom_col() +
  theme_bw() +
  scale_fill_manual(values = c("goldenrod2", "brown4"), name = "U.S. Ally") +
  labs(y = "Number of Critical Minerals Imported by the U.S.",
       x = "Country",
       title = "How many critical minerals are imported from non-Allies?",
       subtitle = "Slightly more than 50% of all critical minerals are imported from non-allies to the U
  theme(axis.text.y = element_text(size=11))
```
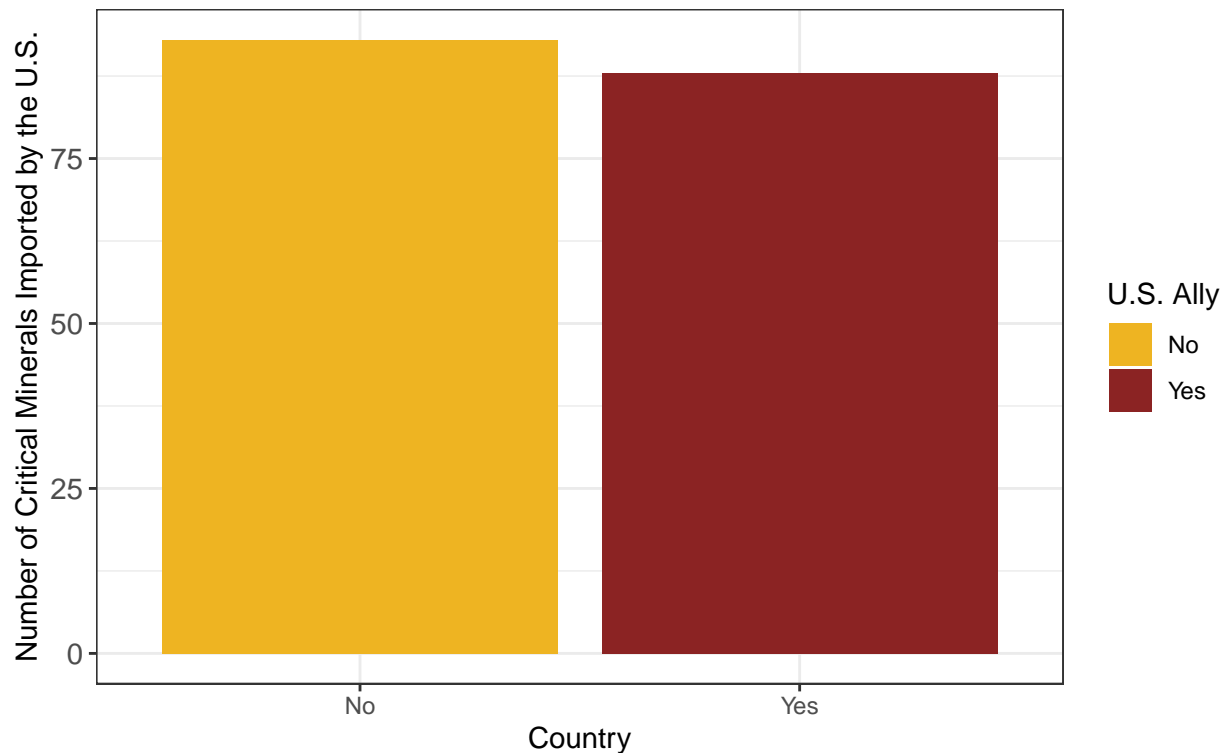

How does the U.S. use imported critical minerals?

```
# every mineral graph
minerals %>%
  group_by(Primary.Application.Collapsed) %>%
  count() %>%
  filter(!is.na(Primary.Application.Collapsed)) %>%
  ggplot(aes(area = n, fill = n, label = Primary.Application.Collapsed)) +
  geom_treemap() +
  theme_void() +
```

```
geom_treemap_text(colour = "white",
                  place = "centre",
                  grow = FALSE,
                  min.size = 4,
                  reflow = TRUE) +
scale_fill_palette_c(met_palettes$Greek, direction = -1) +
labs(fill = "Number of Critical Minerals",
     title = "How does the U.S. use imported critical minerals?",
     subtitle = "Critical minerals are used across numerous important applications."
     )
```

How does the U.S. use imported critical minerals?
Critical minerals are used across numerous important applications.
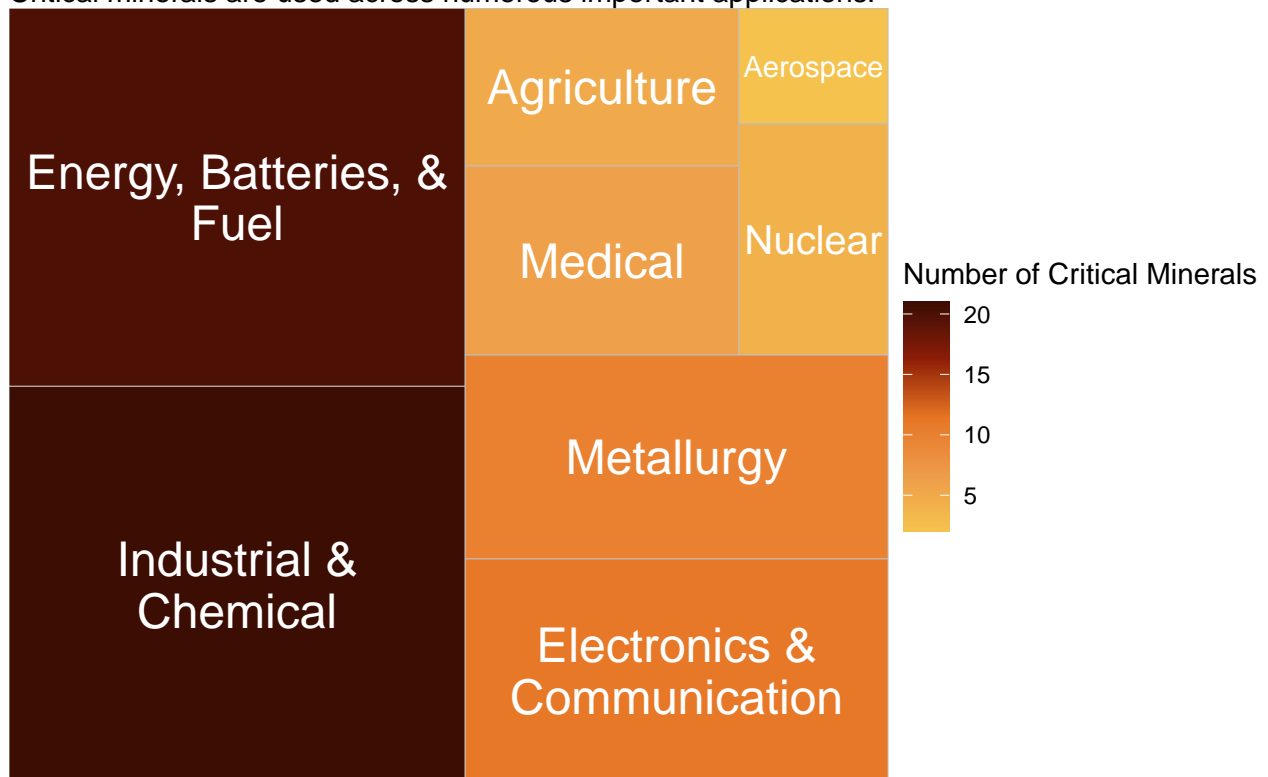

Which critical minerals are relied on entirely through import?

```
minerals %>%
  filter(!is.na(Net_Import_Reliance_pct_2022)) %>%
  ggplot(aes(x = fct_reorder(Mineral, Net_Import_Reliance_pct_2022), y = Net_Import_Reliance_pct_2022,
  geom_col() +
  coord_flip() +
  theme_bw() +
  scale_fill_palette_c(met_palettes$Greek, direction = -1) +
  scale_y_continuous(expand = c(0, 0)) +
  labs(x = "Mineral",
       y = "% U.S.Import Reliance ",
```

```
      fill = "% Net Import Reliance, 2022",
      title = "Which critical minerals are relied entirely through imports?",
      subtitle = "Seventeen minerals have nearly 100% foreign reliance.") +
  theme(axis.text.y = element_text(size=5))
```

Which critical minerals are relied entirely through imports?
Seventeen minerals have nearly 100% foreign reliance.
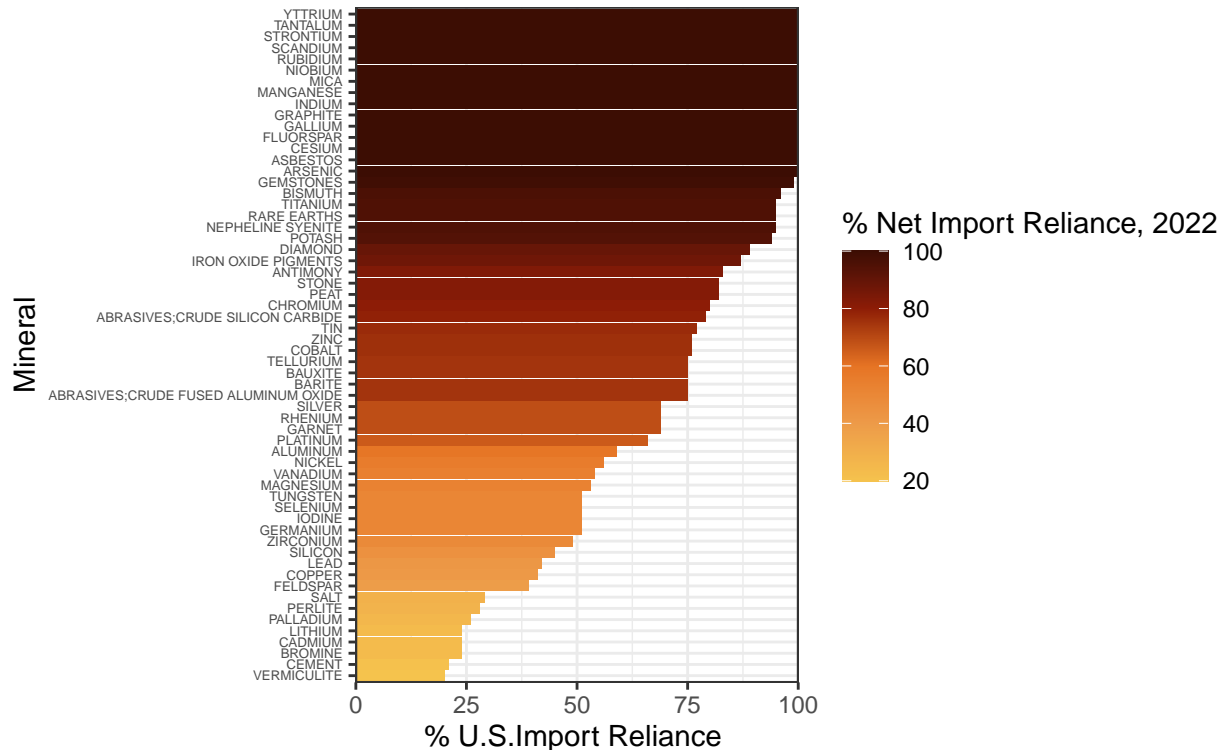
Where do the top 17 critical minerals come from?

```
top_minerals <- minerals %>%
  filter(Net_Import_Reliance_pct_2022 > 95)

top_minerals_long <- top_minerals %>%
  separate(Country, into=c("c1", "c3", "c4", "c5"), sep = ";") %>%   # max of 5
  select(-Primary.Applications) %>%
  pivot_longer(!c(1:3,8), names_to = "key", values_to = "Country") %>%
  group_by(Country) %>%
  summarize(Count = n(), Proportion = n()/17) %>%
  filter(!is.na(Country)) %>%
  left_join(allies, by = "Country") %>%
  mutate(isAlly = ifelse(is.na(isAlly), "No", isAlly), unMember = ifelse(is.na(unMember), "No", unMember
```

```
## Warning: Expected 4 pieces. Additional pieces discarded in 1 rows [11].
```

```
## Warning: Expected 4 pieces. Missing pieces filled with `NA` in 6 rows [1, 2, 4, 12, 13,
```

5

```
## 15].
```

```
top_minerals_long %>%
  ggplot(aes(x = fct_reorder(Country, Proportion), y = Proportion, fill = isAlly)) +
  geom_bar(stat = "identity") +
  coord_flip() +
  theme_bw() +
  scale_fill_manual(values = c("goldenrod2", "brown4"), name = "U.S. Ally") +
  ylim(0,30) +
  scale_y_continuous(expand = c(0, 0)) +
  labs(y = "Proportion of Total U.S. Critical Mineral Imports with High Foreign Reliance",
       x = "Country",
       title = "Where do the critical minerals with high foreign reliance \ncome from?",
       subtitle = "The majority come from China, followed by Germany.") +
  theme(axis.text.y = element_text(size=6))
```

```
## Scale for y is already present.
## Adding another scale for y, which will replace the existing scale.
```


Where do the critical minerals with high foreign reliance come from?

The majority come from China, followed by Germany.
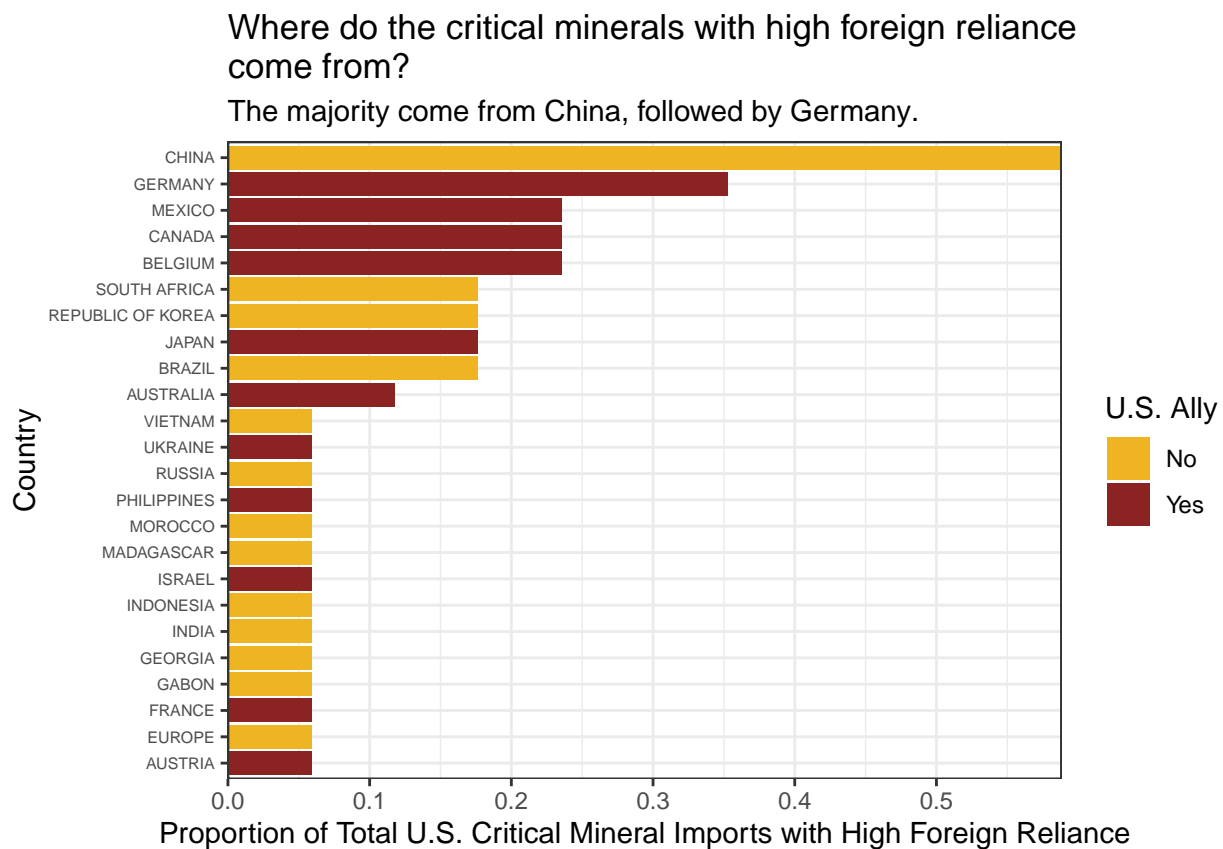
Which applications would be most impacted if we were to lose one or more of the top foreign import critical minerals?

```
# top 17 mineral graph
top_minerals %>%
  group_by(Primary.Application.Collapsed) %>%
  count() %>%
  filter(!is.na(Primary.Application.Collapsed)) %>%
  ggplot(aes(area = n, fill = n, label = Primary.Application.Collapsed)) +
  geom_treemap() +
  theme_void() +
  geom_treemap_text(colour = "white",
                    place = "centre",
                    grow = FALSE,
                    min.size = 4,
                    reflow = TRUE) +
  scale_fill_palette_c(met_palettes$Greek, direction = -1) +
  labs(fill = "Number of Critical Minerals",
       title = "How does the U.S. use high-reliance imported minerals?",
       subtitle = "Industrial & chemical fields, followed by energy, battery, & fuel, would be most impa
       )
```

How does the U.S. use high−reliance imported minerals?

Industrial & chemical fields, followed by energy, battery, & fuel, would be most impacted by the
loss of one or more of these high−reliance minerals.