Project Part 3

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Question: Does NFL carry-over cap space differ between the two conferences?

-Data Description

The selected data, which is located in the appendix at the end of this report, contains information on all 32 NFL teams (column=Team), the carry-over cap space that each team will have at the start of 2019 (column=carry_Over), and the conference (column=Conference). Every category is observational. The NFL cap space is a measure of the salary cap, which is a rule that limits the amount of money teams can put towards their players' salary. If the owners spend past the salary cap, there are fines associated. Each team has the same amount of cap space to work with, but every year this cap space gets bigger. The carry-over cap space is dependent on our cap space from 2018 and other adjustments. This money is the amount of left over cap space as well as some other financial adjustments. The carry-over cap space shows what type of money owners will have to sign new contracts, as the respective team "carries over" into the next season. It is possible that teams with better records won't have much carry-over Cap to work with, as they signed as many players as they could. On the other hand, teams with worse records could have small carry-over cap space as well, because they paid bad players too much money. It is clear that the carry-over cap space poses as a potential financial parallel to a team's performance.

-Relevance

We have data from all 32 NFL Teams as wll as their respective carry-over cap, of which 16 are in the NFC and 16 are in the AFC. The goal is to find out whether there is a significant difference between the average carry-over cap space between AFC teams and NFC teams.

-Generalization

We have data from the population of carry-over cap space by each conference in the NFL for the 2019 season only. We hope that we can generalize this data to a super population, in this case the carry-over cap space by each conference, from 1970 onwards. In this case, our 2019 data is a psuedo-sample for the overarching population data we are trying to describe. After our test, we should be able to make a comment on the NFL as a whole through the two conferences in reference to their carry-over cap, assuming this 2019 data is representative. If we come to a conclusion that they are different, more exploratory analysis can be deployed

to see if there is a possible link between wins and the carry-over cap space.

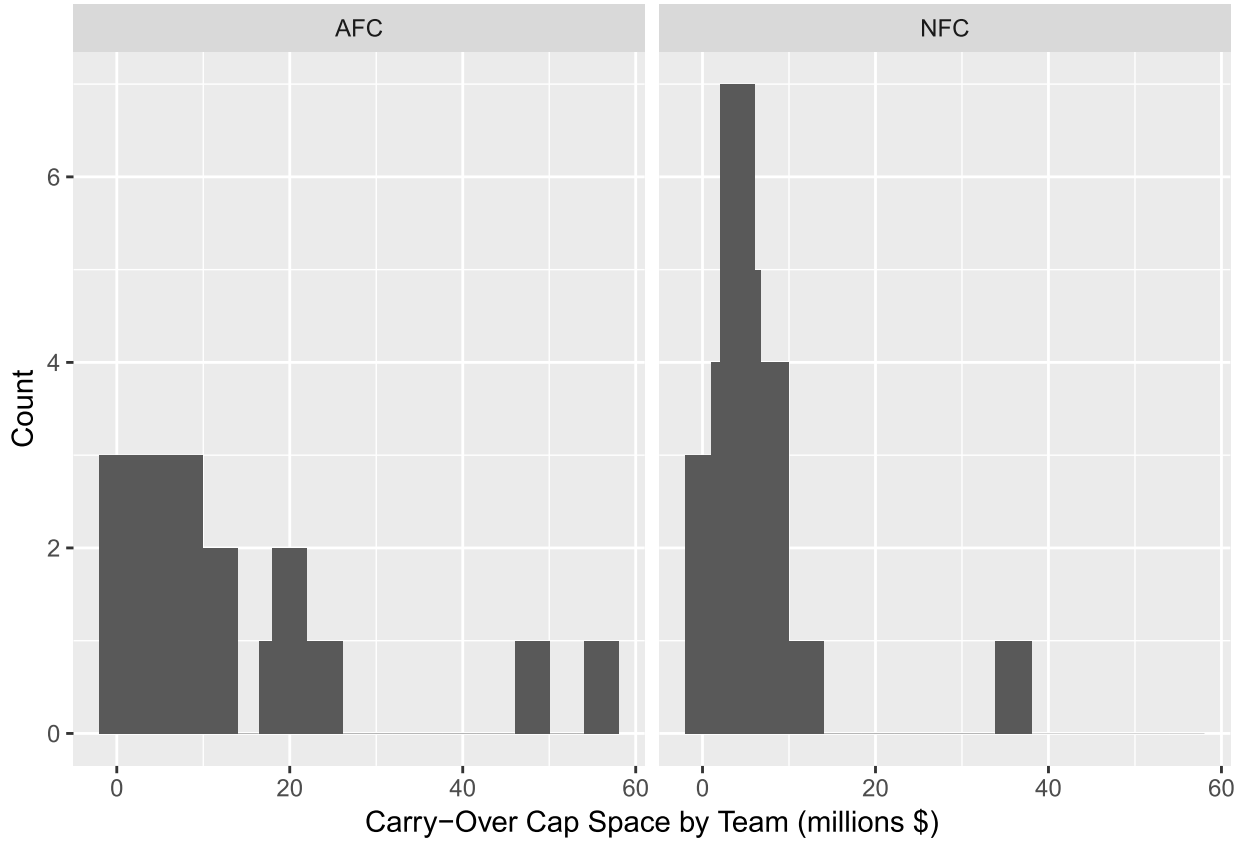
-Test Appropriateness and Selection

We have quantitative data, but before we can decide what specific test to use, we should determine if our distributions are (approximately) normal or not. To start, a histogram of the distributions will be analyzed.

```
library(ggplot2)

hist1 <- ggplot(d, aes(x = Carry_Over))
hist1 + geom_histogram() + facet_grid(. ~ Conference) + stat_bin(bins = 15) +
    labs(y = "Count", x = "Carry-Over Cap Space by Team (millions $)")

## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



Our two conferences only contain 16 teams each, and when looking at the histogram, we can see that both distributions are skewed right. We will want to test the medians in this case.

Our data perfectly meets the assumptions of the Wilcoxon rank-sum test.

(1) We are comparing medians. This was confirmed through the histograms. We have skewed data and a small sample size and therefore should use the median, as no assumptions can be made in regards to approximate normality.

(2) Our populations are continuous. Cap space for both our populations are in millions; it would take an infinite amount of time to count every possible combination of millions of dollars. This confirms that our populations are continuous.

(3) Our populations are independent. For a little bit of background, the AFC and NFC conferences were merged to be declared the NFL in 1970; so by definition of independence, the probability of the AFC existing does not affect the probability of the NFC existing.

-Carrying out the Test and Conclusion

```
## Ho: M1=M2 vs. Ha: M1 != M2 Where M1 is the population
## median of the AFC carry-over cap and M2 is the population
## median of the NFC carry-over cap.
AFCCap <- Carry_Over[1:16]
NFCCap <- Carry_Over[17:32]
wilcox.test(AFCCap, NFCCap, alternative = "two.sided", exact = FALSE)
```

```
##
##  Wilcoxon rank sum test with continuity correction
##
## data:  AFCCap and NFCCap
## W = 174, p-value = 0.08626
## alternative hypothesis: true location shift is not equal to 0
```

Statistically speaking, at a significance level of 0.05, we fail to reject our null hypothesis as our pvalue (0.09) is greater than alpha (0.05). Generally, we say that our true average carry-over cap space is NOT significantly different between the AFC and the NFC. We should be wary however, as the power of statistical tests is low when we have a small sample size, such as the one that exists based on the number of teams in the NFL. In regards to the NFL as a whole, we don't believe we can determine the carry-over cap space by conference. Our potential exploratory analysis into wins and carry-over cap space appears to be null; maybe a different variable could provide us with more insight on wins by conference.

References

1.https://tinyurl.com/y292uuzm

2. https://github.com/rstudio/rmarkdown/issues/646

Apendix

```
Carry_Over <- c(8.7, 5.9, 3.1, 12.2, 4.5, 7.4, 56.5, 18.2, 18.8,
    49.1, 11.6, 25.6, 8, 0.72, 1.9, 1, 11.7, 6.2, 5.9, 5, 3.6,
    6.4, 4.1, 7.8, 1.1, 2.5, 1.8, 4.5, 6.4, 35, 2.5, 0.47)
Team <- c("Bills", "Dolphins", "Patriots", "Jets", "Ravens",
    "Bengals", "Browns", "Steelers", "Texans", "Colts", "Jaguars",
    "Titans", "Broncos", "Chiefs", "Raiders", "Chargers", "Cowboys",
    "Eagles", "Giants", "Redskins", "Bears", "Lions", "Vikings",
    "Packers", "Falcons", "Panthers", "Saints", "Bucs", "Cardinals",
    "49ers", "Seahawks", "Rams")
Conference <- c(rep("AFC", 16), rep("NFC", 16))
d <- data.frame(Team, Conference, Carry_Over)
## ref 1 was used to acquire carry-over cap metrics.
```