



# Merrimack Football Internship

Jared Dunn



**MERRIMACK COLLEGE**  
SCHOOL OF ENGINEERING & COMPUTATIONAL SCIENCES



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# Introduction

**Task:** During the Spring Semester, I teamed up with the Merrimack Football Team to perform a play-by-play analysis for the last five games of the 2024 season.

**Significance:** By understanding basic trends in the data, we are able to identify variables that are correlated with each other, ultimately influencing the success of the team.



# About The Data

Play_ID	Play_Type	Personnel	Quarter	Play_Clock	Down	Distance	Hash	Field_Position	Gain_Loss	Touchdown	Penalty	Penalty_Type	Result
Rock Axe 44 Visor	Midzone	11	1	14:53	1	10	L	-30	5	No	No		Rush
Lion 40 War Spotify	RPO	11	1	14:43	2	5	R	-35	4	No	No		Completed Pass
Lake Weak Dice 23 B Trump	Counter	12	1	14:16	3	1	L	-39	5	No	No		Rush
Lou Lasso 17 License Miami	Smash	10	1	13:39	1	10	L	-44	5	No	No		Completed Pass
Load Axe 45 Visor	Midzone	11	1	13:05	2	5	R	-49	1	No	No		Rush
List 47 Yacht	Midzone	11	1	12:28	3	4	M	50	8	No	No		Rush
Rich Tite Lasso F Flip 42 Bat	Inside Zone	12	1	11:56	1	10	L	42	7	No	No		Rush
List Tite Lasso F Flip 43 Bat	Inside Zone	12	1	11:15	2	3	M	35	20	No	No		Rush
Lou Salem 41 Y Raft	RPO	11	1	10:42	1	10	L	15	7	No	No		Scramble
Roy OK Thor	QB Draw	10	1	10:04	2	3	M	8	0	No	No		Incomplete Pass
Ranger 42 Cap	Inside Zone	12	1	9:30	3	3	M	8	8	No	No		Incomplete Pass
List Buzz 29 Bang	Pin/Pull	11	1	7:47	1	10	L	-34	5	No	No		Rush
Roy A Bluff 26 B Lead	QB Iso	10	1	7:40	2	5	L	-39	6	No	No		QB Keep
List Rope Pez 47	Midzone	11	1	6:56	1	10	R	-45	6	No	No		Rush

Example: Stonehill.csv



# Data Wrangling

The following variables were converted  
to numeric:

- Down
- Quarter
- Distance
- Field\_Position
- Gain\_Loss

Play_ID <chr>	Play_Type <fctr>	Personnel <int>	Quarter <dbl>	Play_Clock <chr>	Down <dbl>	Distance <dbl>	Hash <chr>	Field_Position <dbl>
1 Rock Axe 44 Visor	Midzone	11	1	14:53	1	10	L	-30
2 Lion 40 War Spotify	RPO	11	1	14:43	2	5	R	-35
3 Lake Weak Dice 23 B Trump	Counter	12	1	14:16	3	1	L	-39
4 Lou Lasso 17 License Miami	Smash	10	1	13:39	1	10	L	-44
5 Load Axe 45 Visor	Midzone	11	1	13:05	2	5	R	-49
6 List 47 Yacht	Midzone	11	1	12:28	3	4	M	50

**Target Variable: Gain\_Loss**



# Game Breakdown: Stonehill



VS.





# Game Breakdown: Stonehill

## Task #1: Play Type Distribution

Play_Type <fctr>	Frequency <int>
Midzone	17
Inside Zone	12
RPO	7
QB Iso	5
Counter	4
Play-Action	4
Veer	4
Pin/Pull	3
Smash	3
QB Draw	2
Double Curls	1
Double Pass	1
RB Screen	1
WR Screen	1



# Game Breakdown: Stonehill

**Task #2:** Personnel Distribution

<b>Personnel</b> <i>&lt;int&gt;</i>	<b>Frequency</b> <i>&lt;int&gt;</i>
12	25
11	21
10	13
21	6



# Game Breakdown: Stonehill

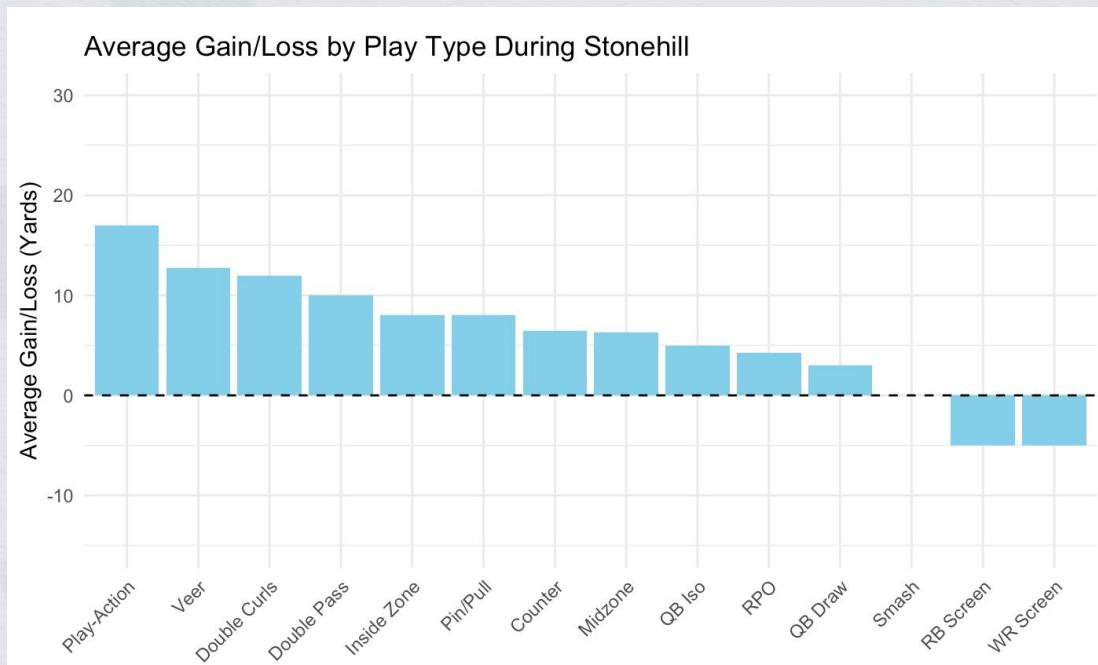
**Task #3:** Average Gain/Loss by Play Type

Play_Type <fctr>	Average_Gain_Loss <dbl>
Play-Action	17.000000
Veer	12.750000
Double Curls	12.000000
Double Pass	10.000000
Inside Zone	8.000000
Pin/Pull	8.000000
Counter	6.500000
Midzone	6.294118
QB Iso	5.000000
RPO	4.285714
QB Draw	3.000000
Smash	0.000000
RB Screen	-5.000000
WR Screen	-5.000000



# Game Breakdown: Stonehill

**Task #4:** Average Gain/Loss by Play Type Visualization





# Game Breakdown: Stonehill

**Task #5:** Average Gain/Loss by Play Type During 2 Minute Drill

**Score:** 27 (Merrimack) - 0  
(Stonehill)

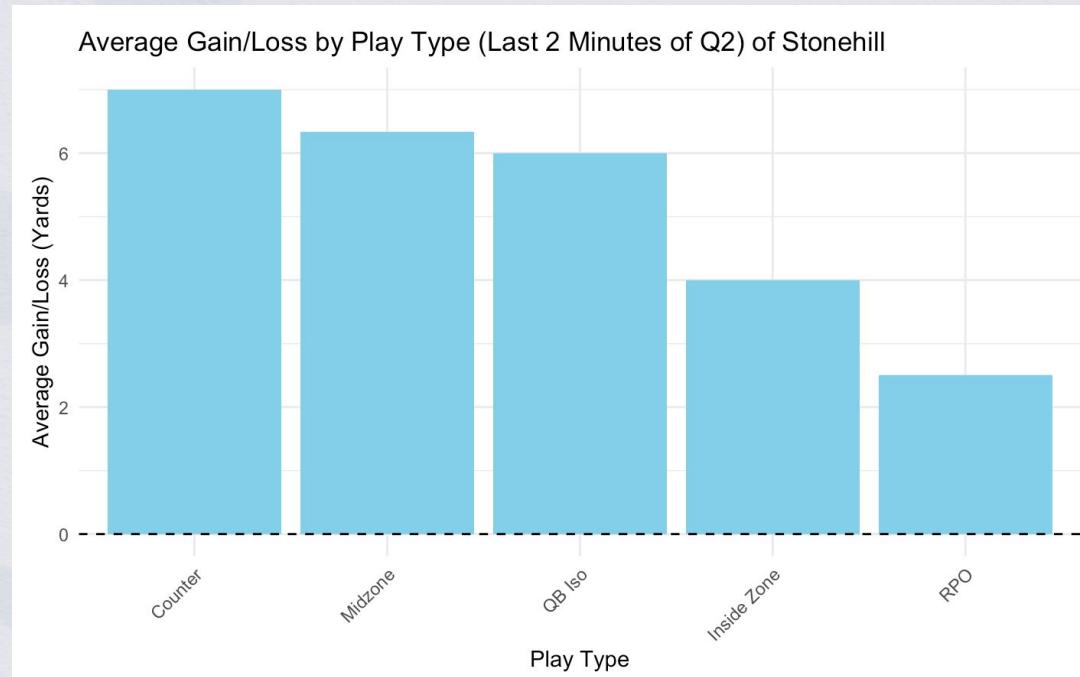
Play_Type <fctr>	Average_Gain_Loss <dbl>
Counter	7.000000
Midzone	6.333333
QB Iso	6.000000
Inside Zone	4.000000
RPO	2.500000



# Game Breakdown: Stonehill

**Task #6:** Average Gain/Loss by Play Type During 2 Minute Drill Visualization

**Score:** 27 (Merrimack) - 0 (Stonehill)





# Game Breakdown: Stonehill

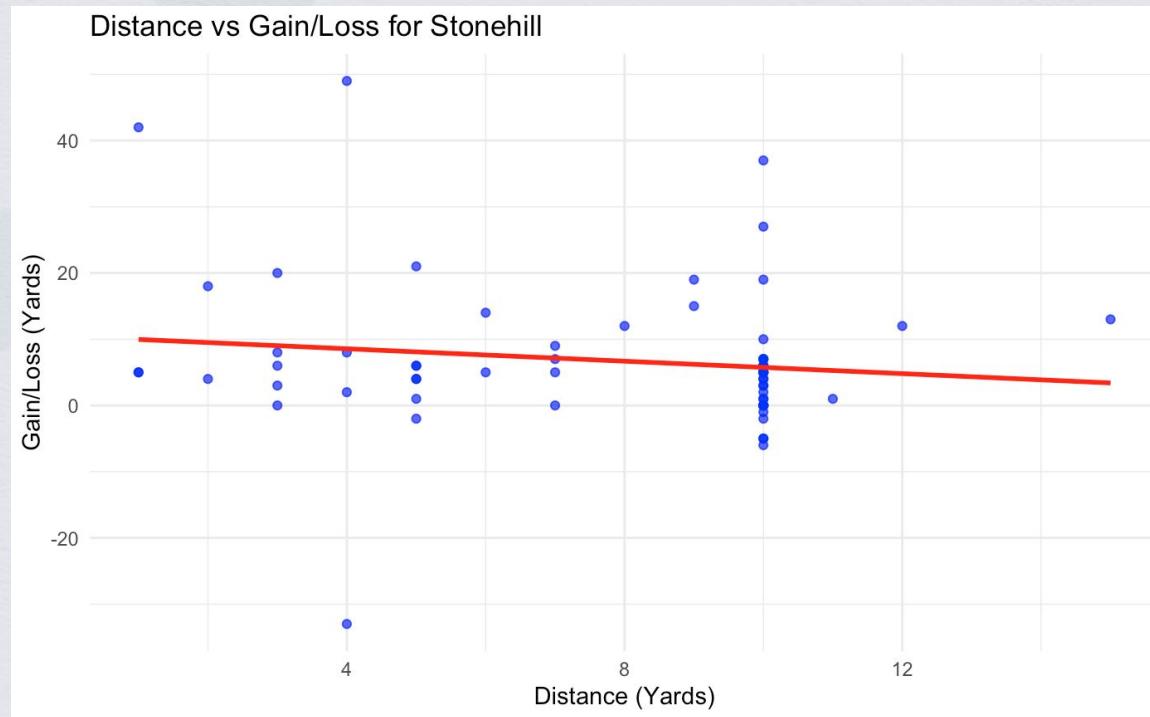
**Task #7:** Identify the Penalties

Penalty_Type <chr>	n <int>
Block In the Back	1
Defensive Facemask	1
Illegal Man Downfield	1



# Game Breakdown: Stonehill

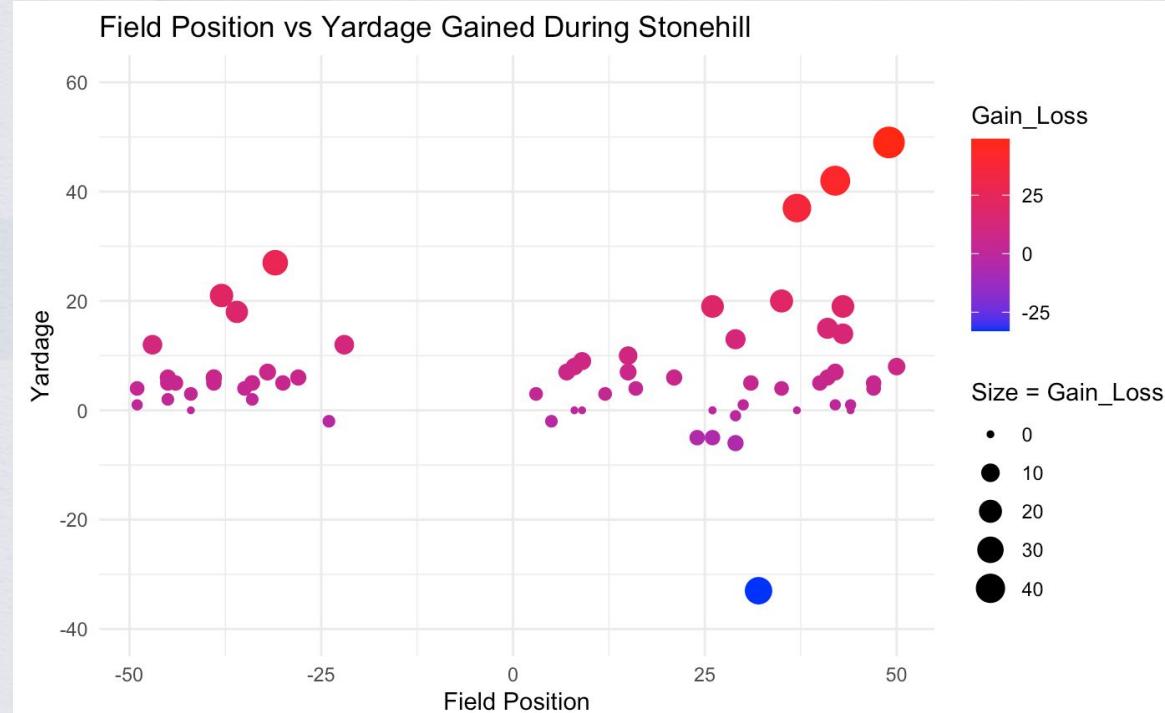
**Task #8:** Display the Distance vs. Gain/Loss throughout the game





# Game Breakdown: Stonehill

**Task #9:** Display the Gain/Loss vs. Field Position throughout the game

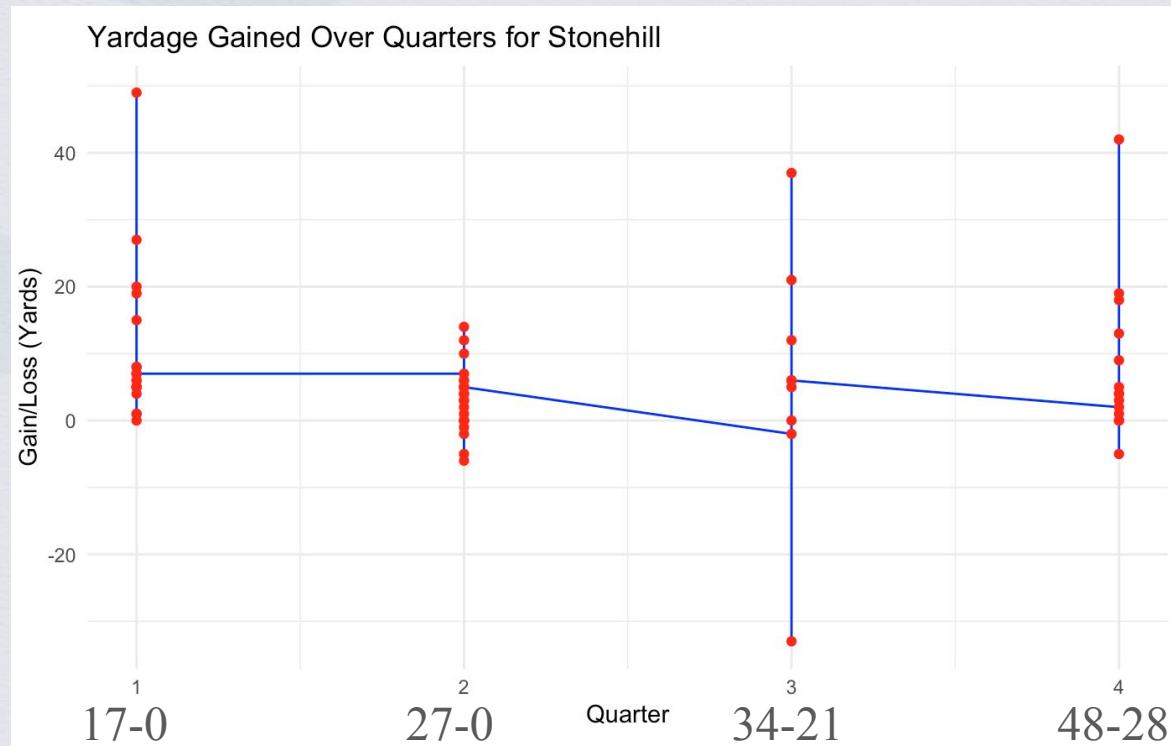




# Game Breakdown: Stonehill

**Task #10:** Display the  
Yardage Gained/Lost in Each  
Quarter

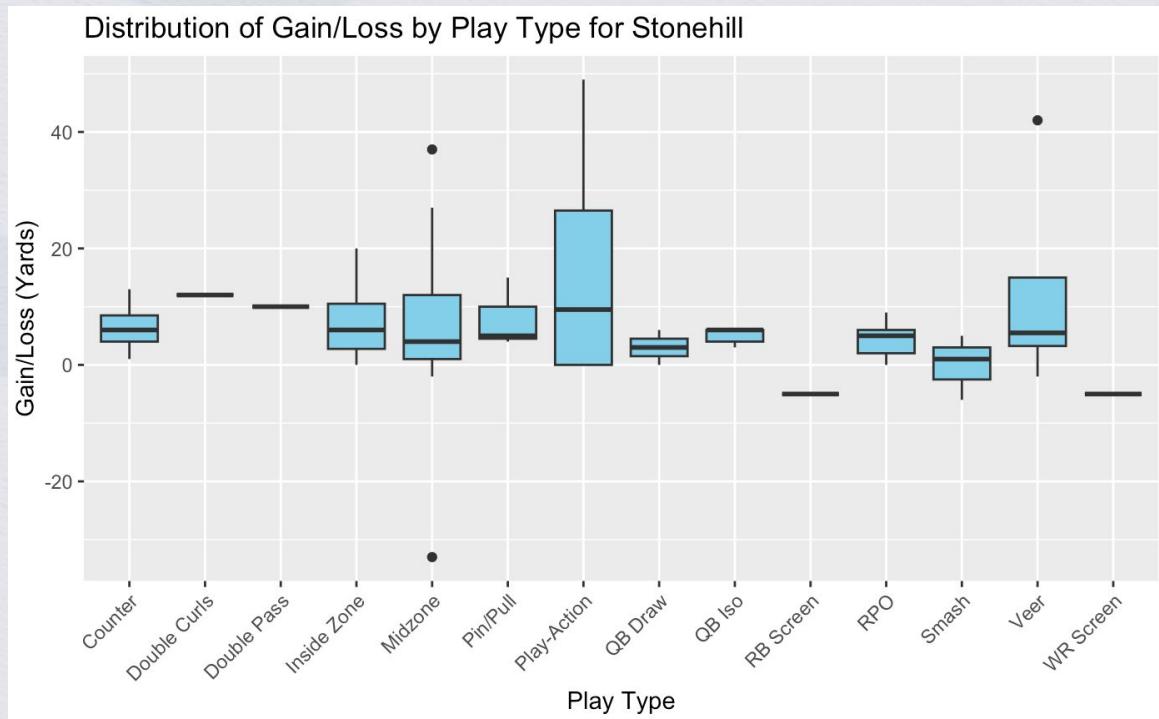
**Score:** (Merrimack - Stonehill)





# Game Breakdown: Stonehill

**Task #11:** Visualize the Average Gain/Loss by Play Type, Along with Their Frequency





# Game Breakdown: Colgate



VS.





# Game Breakdown: Colgate

## Task #1: Play Type Distribution

Play_Type <fctr>	Frequency <int>
Inside Zone	12
Outside Zone	9
Pass	9
Play Action Pass	8
Cram	6
Option	6
RPO	5
Sweep	4
Counter	2
RB Screen	2
Pin/Pull	1
QB Run	1
Same Side Counter	1
Screen	1
Thowback Pass	1
Toss	1



# Game Breakdown: Colgate

**Task #2:** Personnel Distribution

Personnel <int>	Frequency <int>
11	42
12	21
10	5
22	1



# Game Breakdown: Colgate

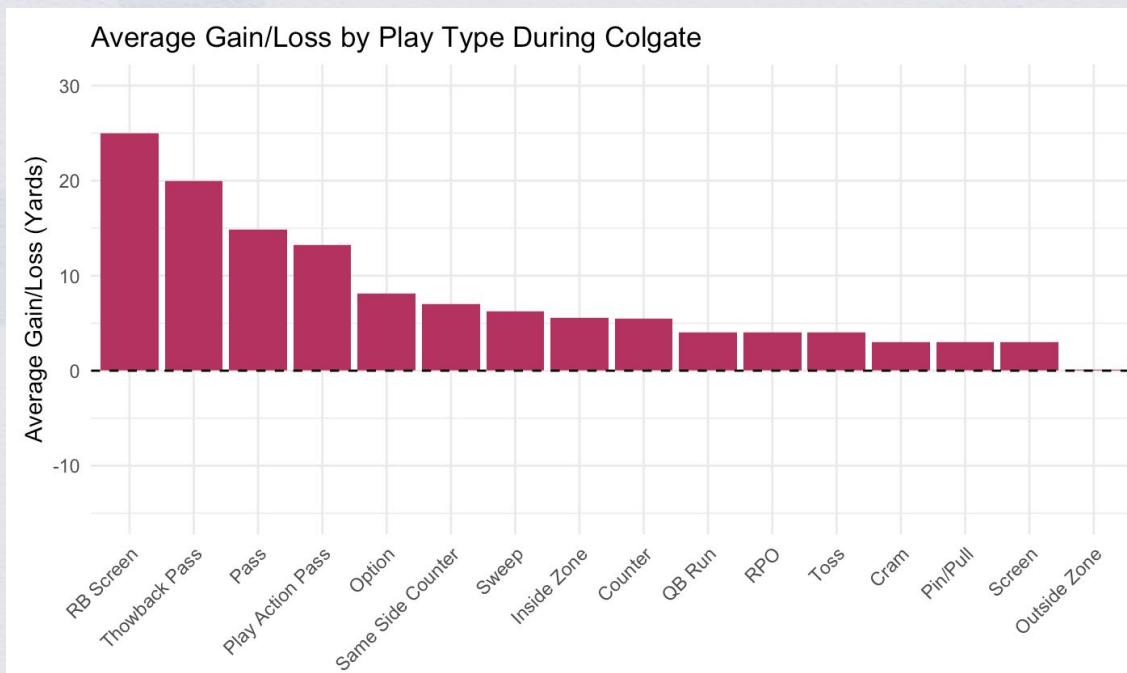
**Task #3:** Average Gain/Loss by Play Type

Play_Type <fctr>	Average_Gain_Loss <dbl>
RB Screen	25.0000000
Throwback Pass	20.0000000
Pass	14.8888889
Play Action Pass	13.2500000
Option	8.1666667
Same Side Counter	7.0000000
Sweep	6.2500000
Inside Zone	5.5833333
Counter	5.5000000
QB Run	4.0000000
RPO	4.0000000
Toss	4.0000000
Cram	3.0000000
Pin/Pull	3.0000000
Screen	3.0000000
Outside Zone	0.1111111



# Game Breakdown: Colgate

**Task #4:** Average Gain/Loss by Play Type Visualization





# Game Breakdown: Colgate

**Task #5:** Average Gain/Loss by Play Type During 2 Minute Drill

**Score:** 17 (Merrimack) - 10 (Colgate)

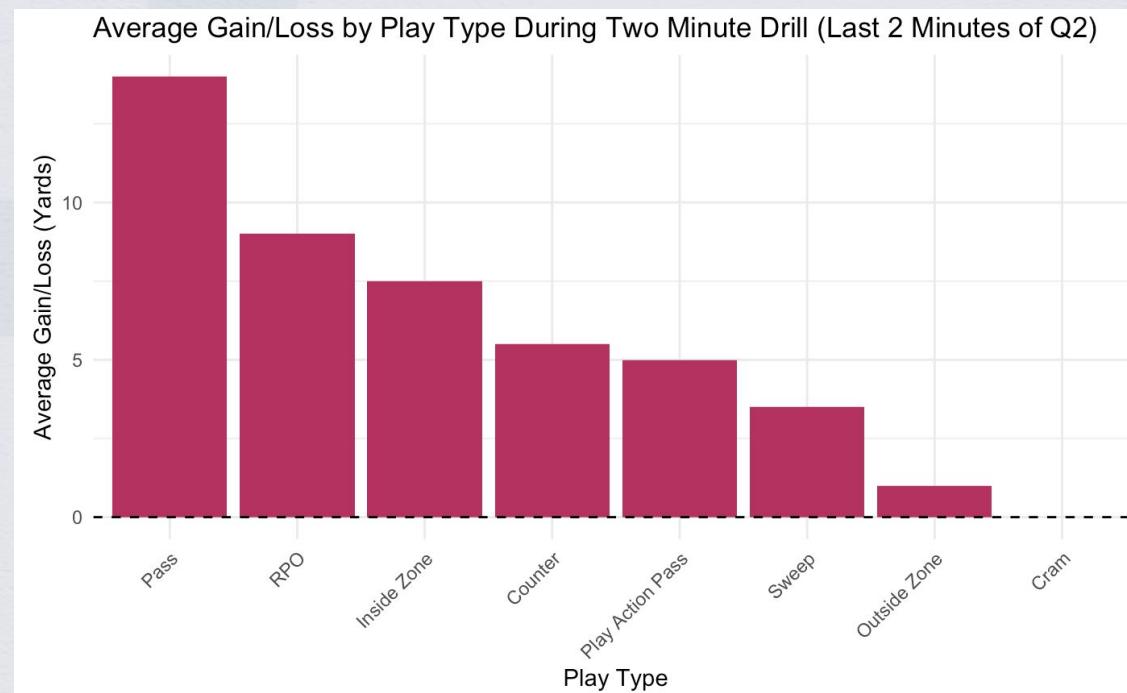
Play_Type <fctr>	Average_Gain_Loss <dbl>
Pass	14.0
RPO	9.0
Inside Zone	7.5
Counter	5.5
Play Action Pass	5.0
Sweep	3.5
Outside Zone	1.0
Cram	0.0



# Game Breakdown: Colgate

**Task #6:** Average Gain/Loss by Play Type During 2 Minute Drill Visualization

**Score:** 17 (Merrimack) - 10 (Colgate)





# Game Breakdown: Colgate

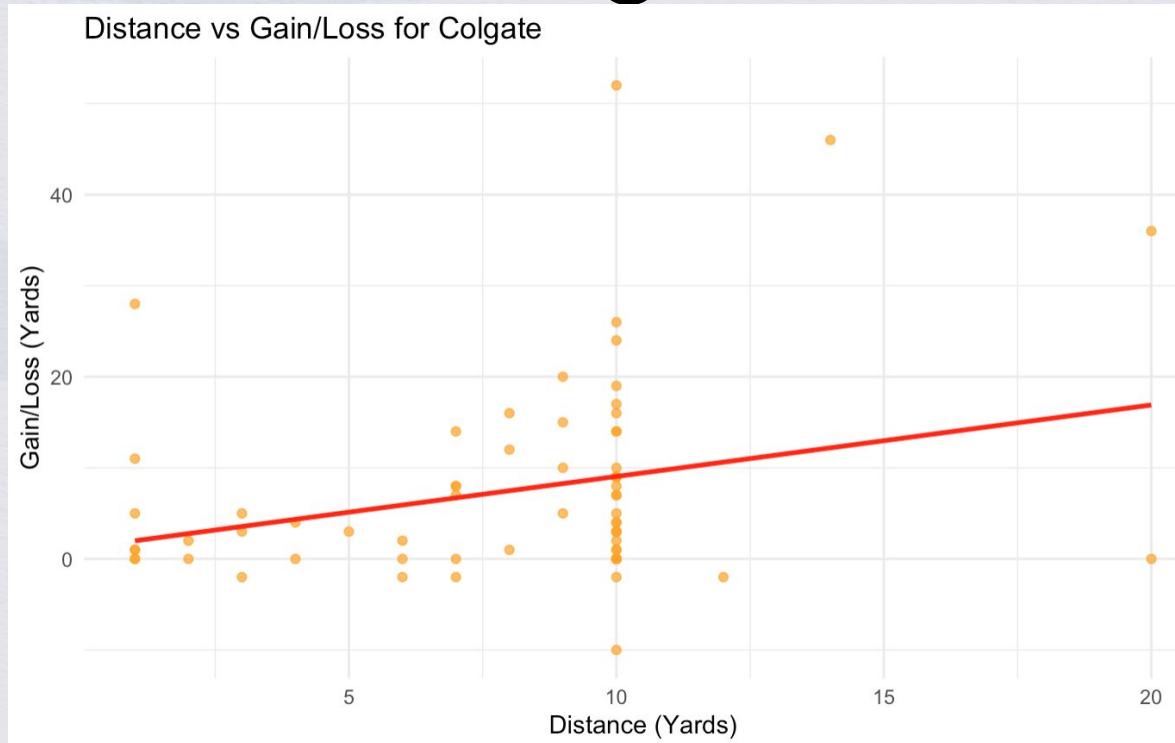
Task #7: Identify the Penalties

Penalty_Type	n
<chr>	<int>
Holding	1



# Game Breakdown: Colgate

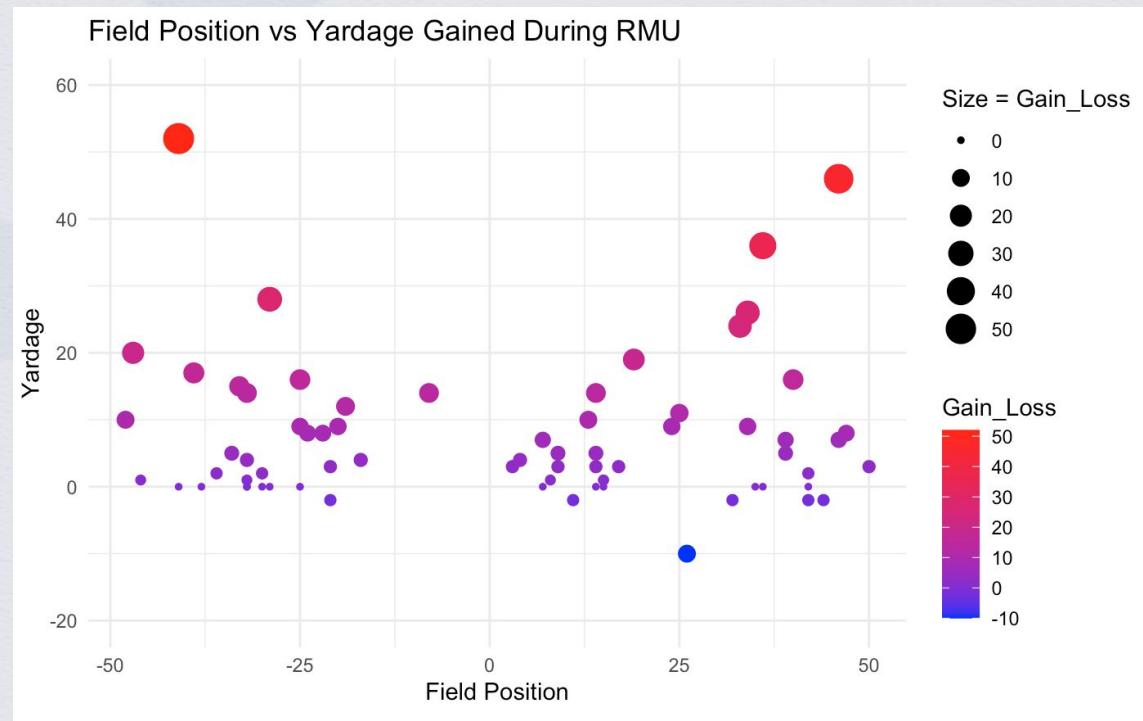
**Task #8:** Display the Distance vs. Gain/Loss throughout the game





# Game Breakdown: Colgate

**Task #9:** Display the Gain/Loss vs. Field Position throughout the game

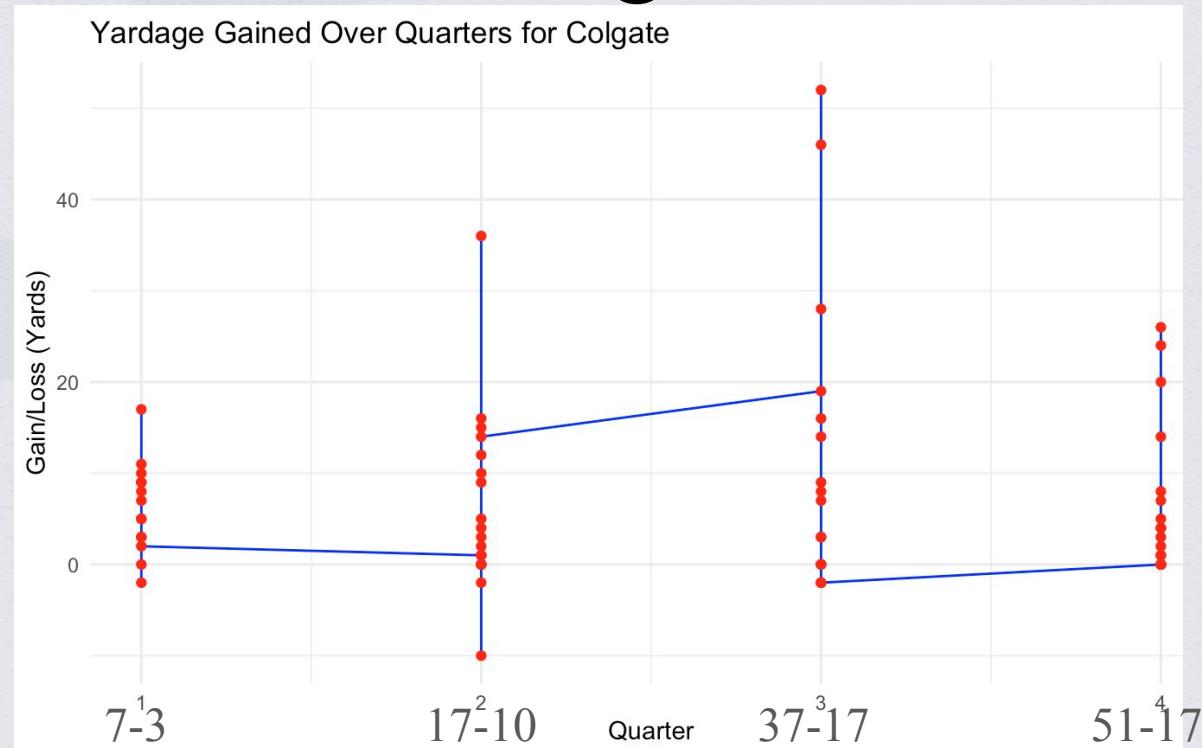




# Game Breakdown: Colgate

**Task #10:** Display the  
Yardage Gained/Lost in Each  
Quarter

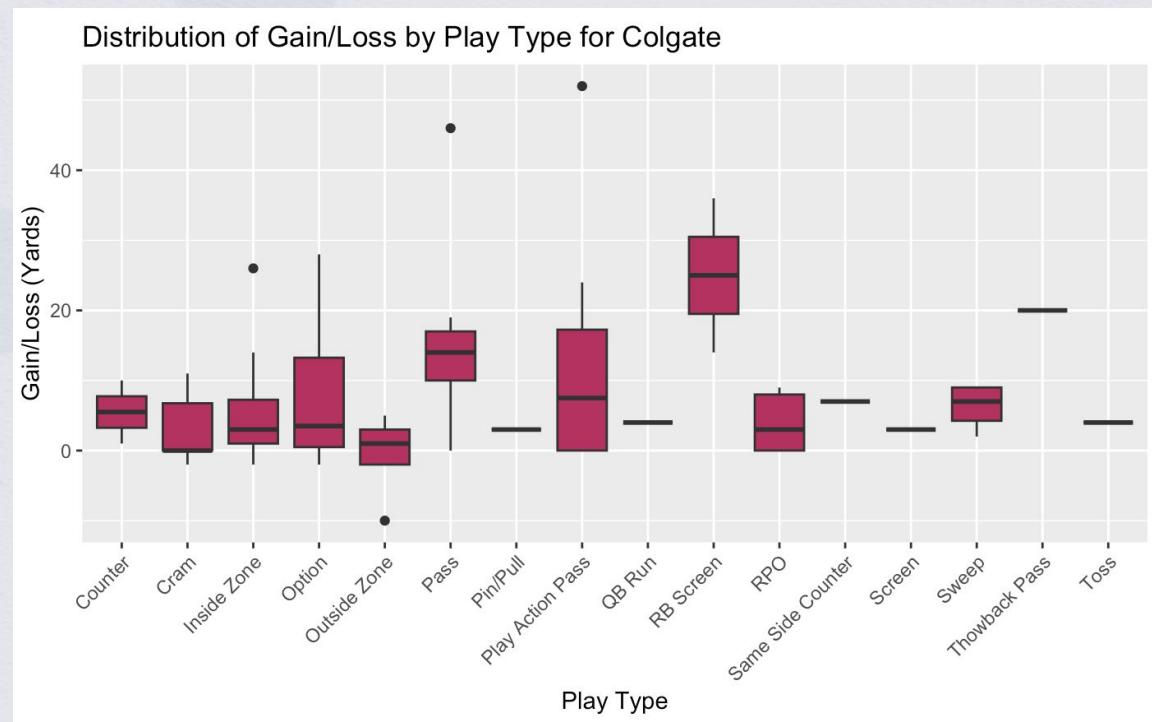
**Score:** (Merrimack - Colgate)





# Game Breakdown: Colgate

**Task #11:** Visualize the Average Gain/Loss by Play Type, Along with Their Frequency





# Game Breakdown: Robert Morris



VS.





# Game Breakdown: Robert Morris

## Task #1: Play Type Distribution

Play_Type <fctr>	Frequency <int>
Pass	15
Inside Zone	12
Play Action Pass	5
Option	4
Outside Zone	4
RB Screen	4
Pin/Pull	3
Draw	2
Duo	2
QB Counter	2
RPO	2
QB Draw	1
Rollout	1
Sweep	1
Throwback Pass	1



# Game Breakdown: Robert Morris

**Task #2:** Personnel Distribution

Personnel <int>	Frequency <int>
11	36
10	12
12	9
20	2



# Game Breakdown: Robert Morris

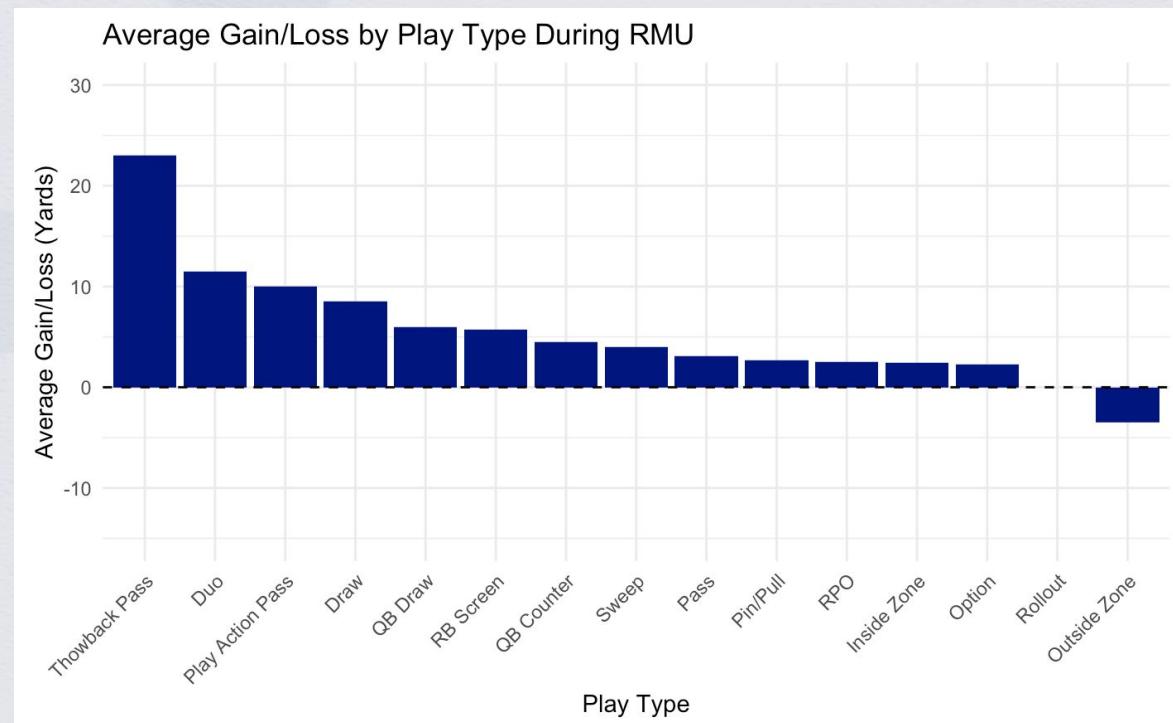
**Task #3:** Average Gain/Loss by Play Type

Play_Type <fctr>	Average_Gain_Loss <dbl>
Thowback Pass	23.000000
Duo	11.500000
Play Action Pass	10.000000
Draw	8.500000
QB Draw	6.000000
RB Screen	5.750000
QB Counter	4.500000
Sweep	4.000000
Pass	3.133333
Pin/Pull	2.666667
RPO	2.500000
Inside Zone	2.416667
Option	2.250000
Rollout	0.000000
Outside Zone	-3.500000



# Game Breakdown: Robert Morris

**Task #4:** Average Gain/Loss by Play Type Visualization





# Game Breakdown: Robert Morris

**Task #5:** Average Gain/Loss by Play Type During 2 Minute Drill

**Score:** 0 (Merrimack) - 0 (Robert Morris)

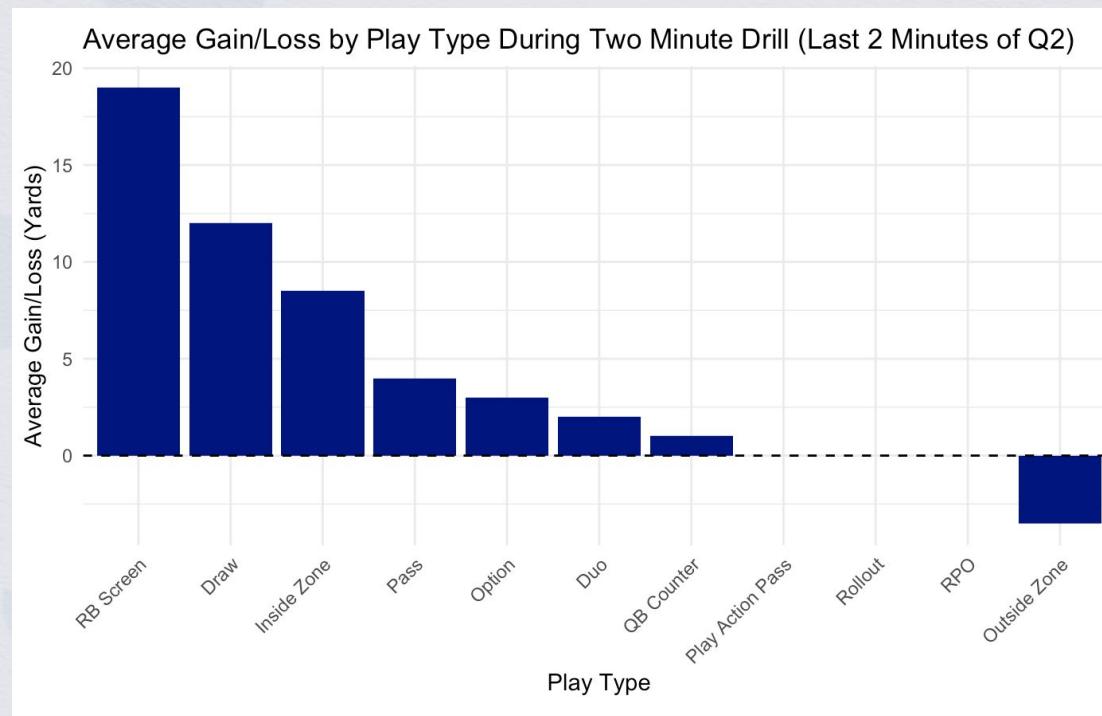
Play_Type <fctr>	Average_Gain_Loss <dbl>
RB Screen	19.0
Draw	12.0
Inside Zone	8.5
Pass	4.0
Option	3.0
Duo	2.0
QB Counter	1.0
Play Action Pass	0.0
Rollout	0.0
RPO	0.0
Outside Zone	-3.5



# Game Breakdown: Robert Morris

**Task #6:** Average Gain/Loss by Play Type During 2 Minute Drill Visualization

**Score:** 0 (Merrimack) - 0 (Robert Morris)





# Game Breakdown: Robert Morris

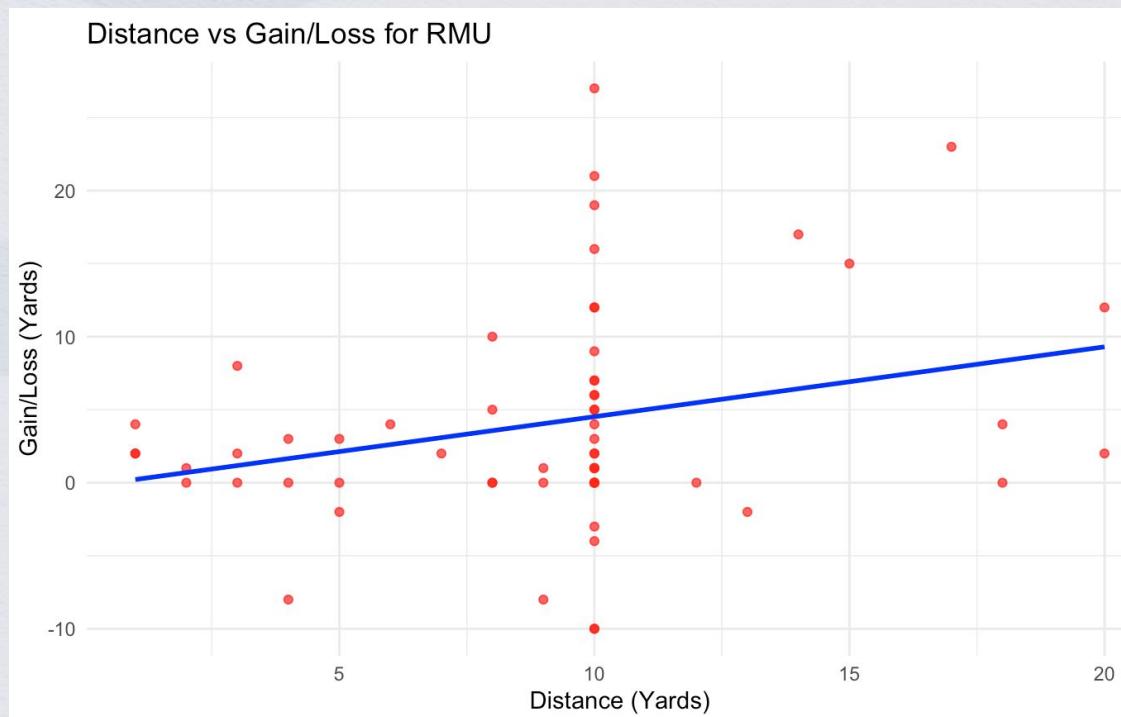
**Task #7:** Identify the Penalties

Penalty_Type	n
<chr>	<int>
Holding	2



# Game Breakdown: Robert Morris

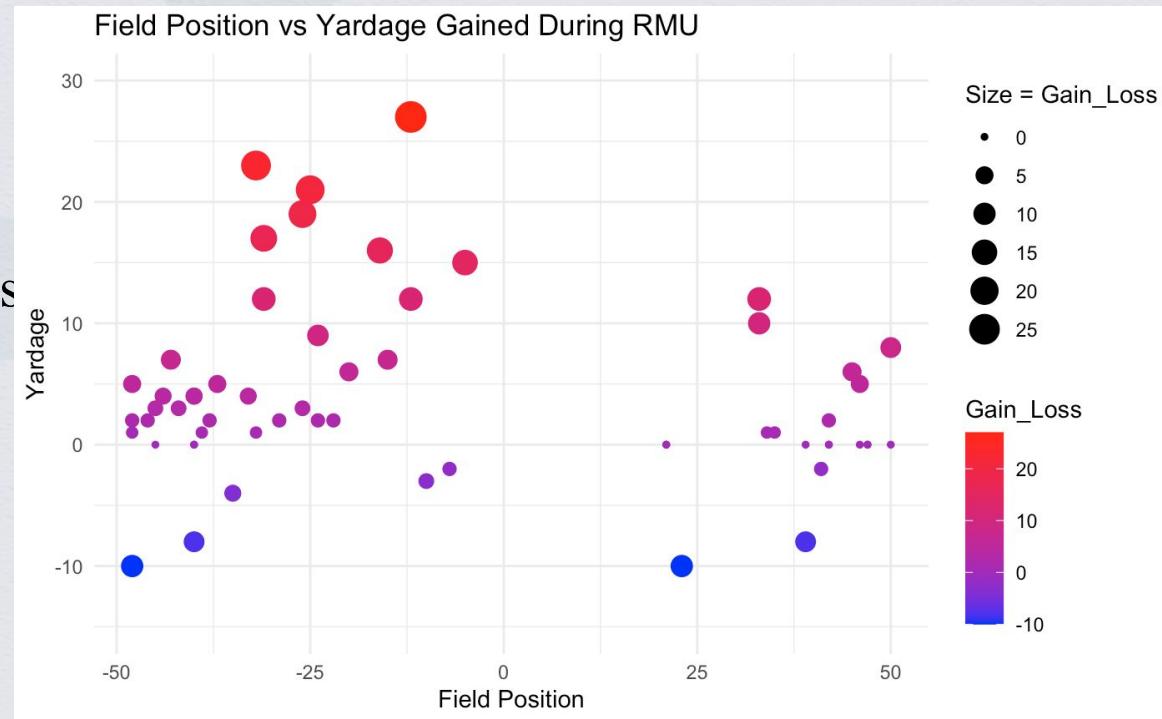
**Task #8:** Display the Distance vs. Gain/Loss throughout the game





# Game Breakdown: Robert Morris

**Task #9:** Display the Gain/Loss vs. Field Position throughout the game

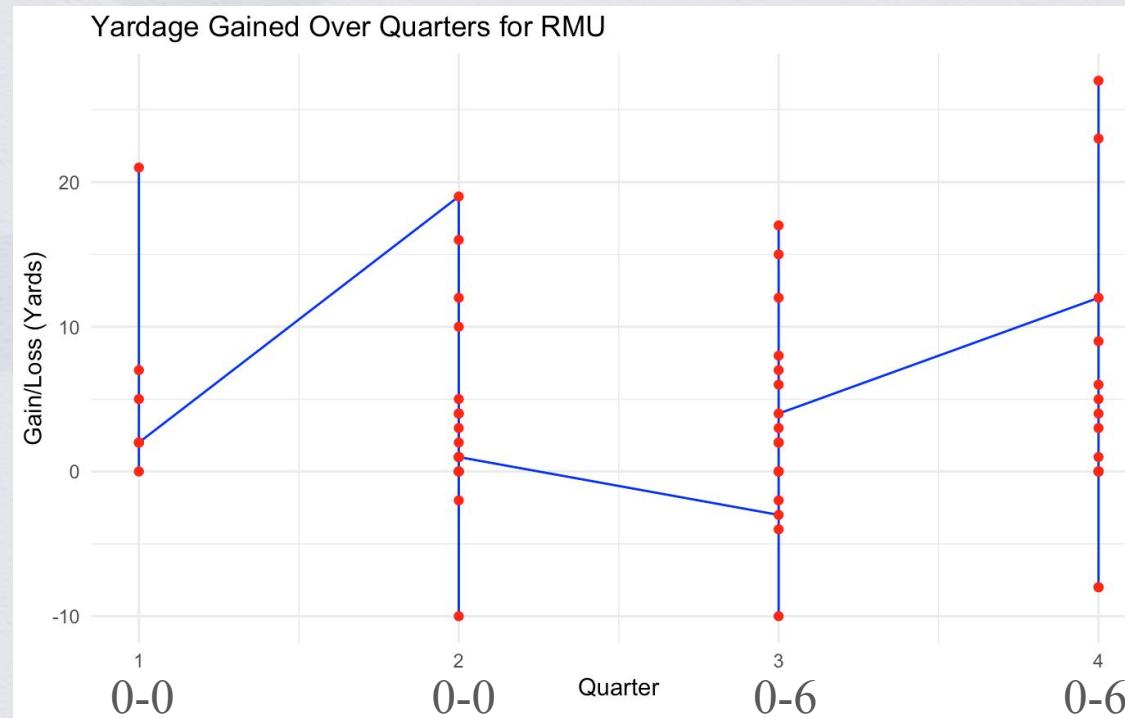




# Game Breakdown: Robert Morris

**Task #10:** Display the Yardage Gained/Lost in Each Quarter

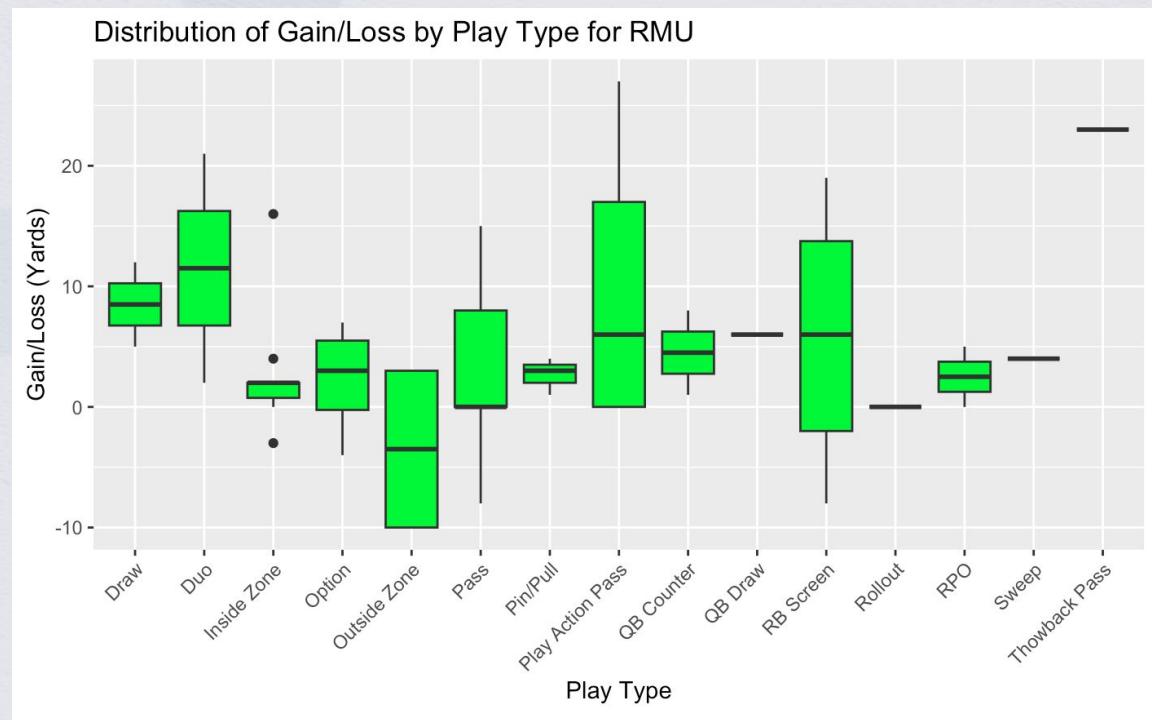
**Score:** (Merrimack - Robert Morris)





# Game Breakdown: Robert Morris

**Task #11:** Visualize the Average Gain/Loss by Play Type, Along with Their Frequency





# Game Breakdown: Sacred Heart



VS.





# Game Breakdown: Sacred Heart

## Task #1: Play Type Distribution

Play_Type <fctr>	Frequency <int>
Inside Zone	17
Pass	16
Play Action Pass	11
Counter	5
Visor	5
Option	4
Draw	3
RPO	3
QB Counter	2
Sweep	2
Outside Zone	1
RB Screen	1
Rollout Pass	1
Throwback Pass	1
Toss	1



# Game Breakdown: Sacred Heart

**Task #2:** Personnel Distribution

<b>Personnel</b> <i>&lt;int&gt;</i>	<b>Frequency</b> <i>&lt;int&gt;</i>
11	55
10	9
12	9



# Game Breakdown: Sacred Heart

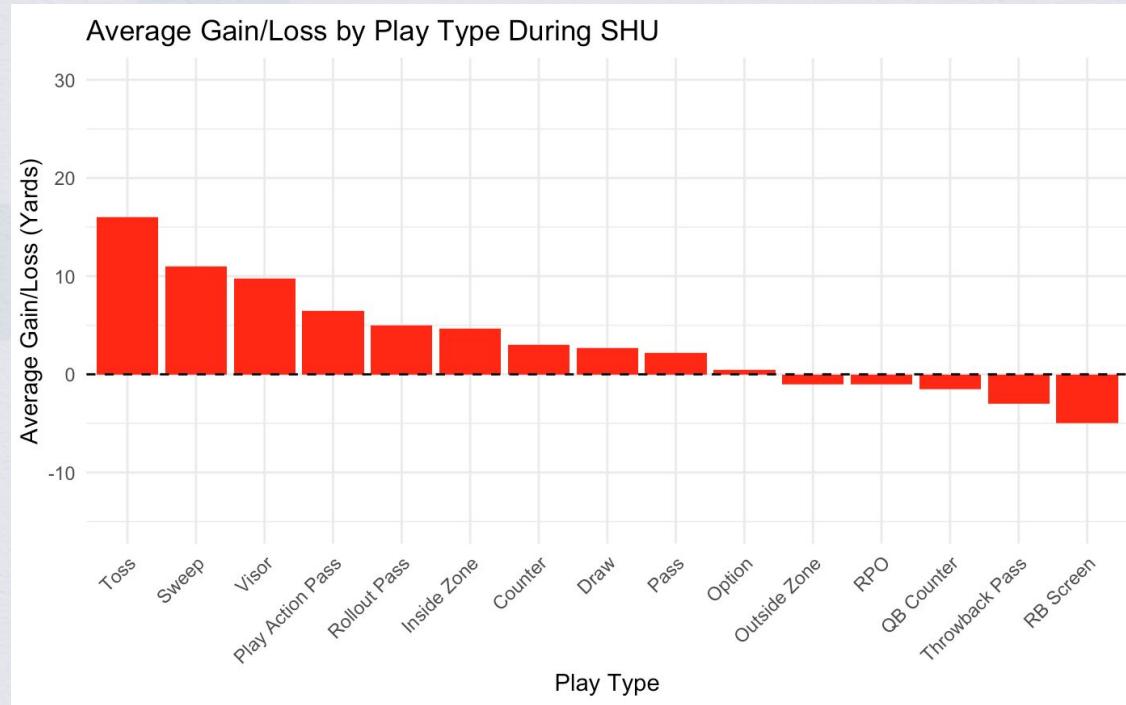
**Task #3:** Average Gain/Loss by Play Type

Play_Type <fctr>	Average_Gain_Loss <dbl>
Toss	16.000000
Sweep	11.000000
Visor	9.800000
Play Action Pass	6.454545
Rollout Pass	5.000000
Inside Zone	4.647059
Counter	3.000000
Draw	2.666667
Pass	2.187500
Option	0.500000
Outside Zone	-1.000000
RPO	-1.000000
QB Counter	-1.500000
Throwback Pass	-3.000000
RB Screen	-5.000000



# Game Breakdown: Sacred Heart

**Task #4:** Average Gain/Loss by Play Type Visualization





# Game Breakdown: Sacred Heart

**Task #5:** Average Gain/Loss by Play Type During 2 Minute Drill

**Score:** 17 (Merrimack) - 14 (Sacred Heart)

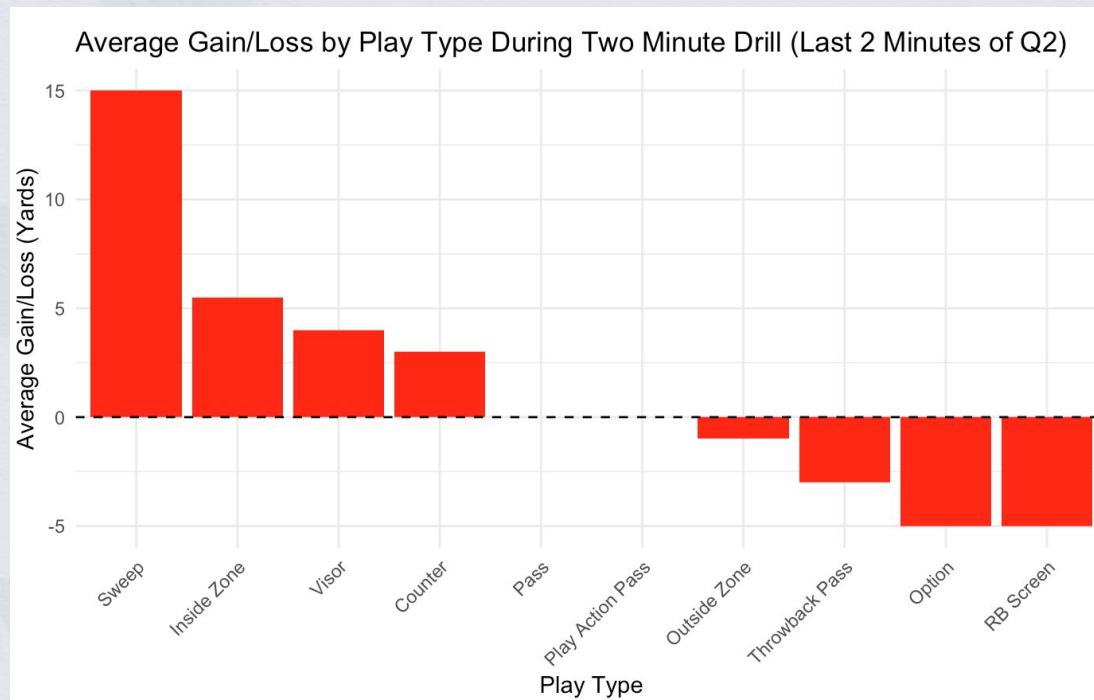
Play_Type <fctr>	Average_Gain_Loss <dbl>
Sweep	15.0
Inside Zone	5.5
Visor	4.0
Counter	3.0
Pass	0.0
Play Action Pass	0.0
Outside Zone	-1.0
Throwback Pass	-3.0
Option	-5.0
RB Screen	-5.0



# Game Breakdown: Sacred Heart

**Task #6:** Average Gain/Loss by Play Type During 2 Minute Drill Visualization

**Score:** 17 (Merrimack) - 14 (Sacred Heart)





# Game Breakdown: Sacred Heart

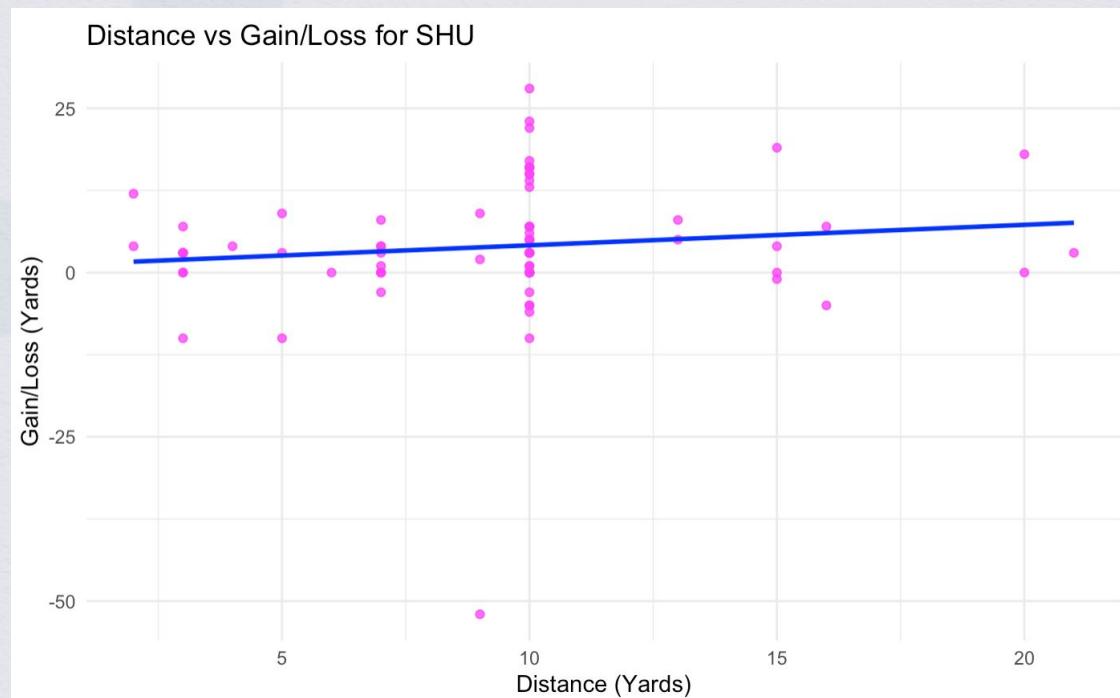
**Task #7:** Identify the Penalties

Penalty_Type	n
	<int>
Def Personal Foul	1
Holding	4
Illegal Man Downfield	1
Offsides	1



# Game Breakdown: Sacred Heart

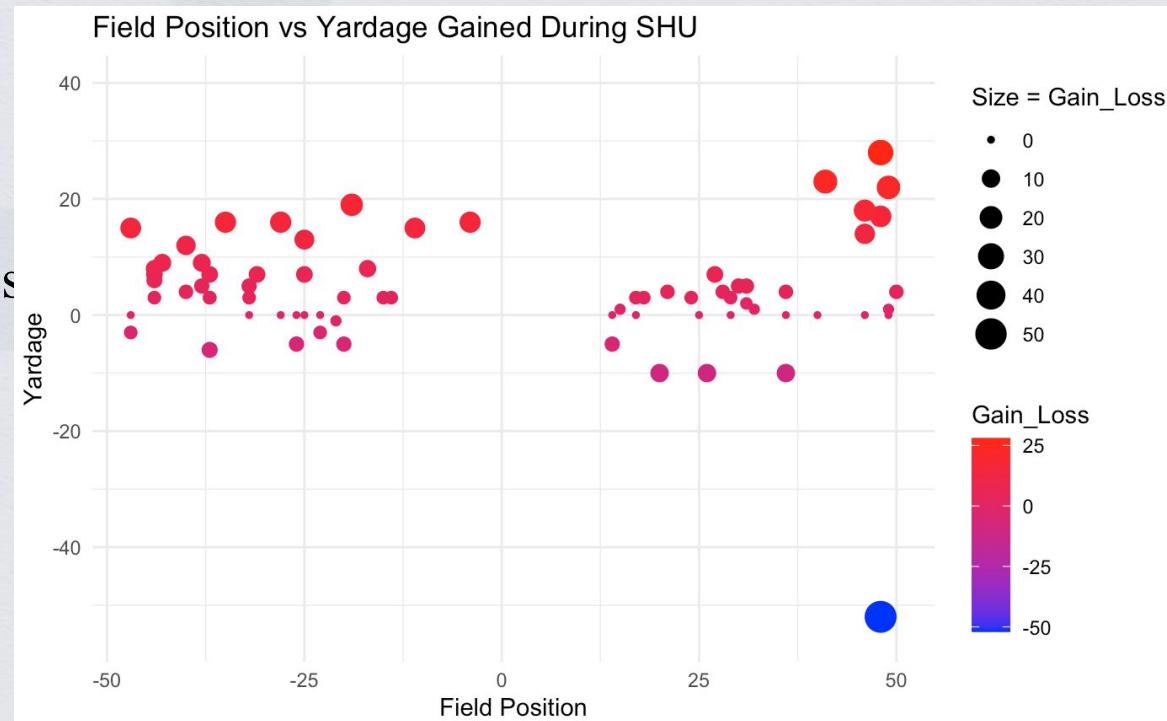
**Task #8:** Display the Distance vs. Gain/Loss throughout the game





# Game Breakdown: Sacred Heart

**Task #9:** Display the Gain/Loss vs. Field Position throughout the game

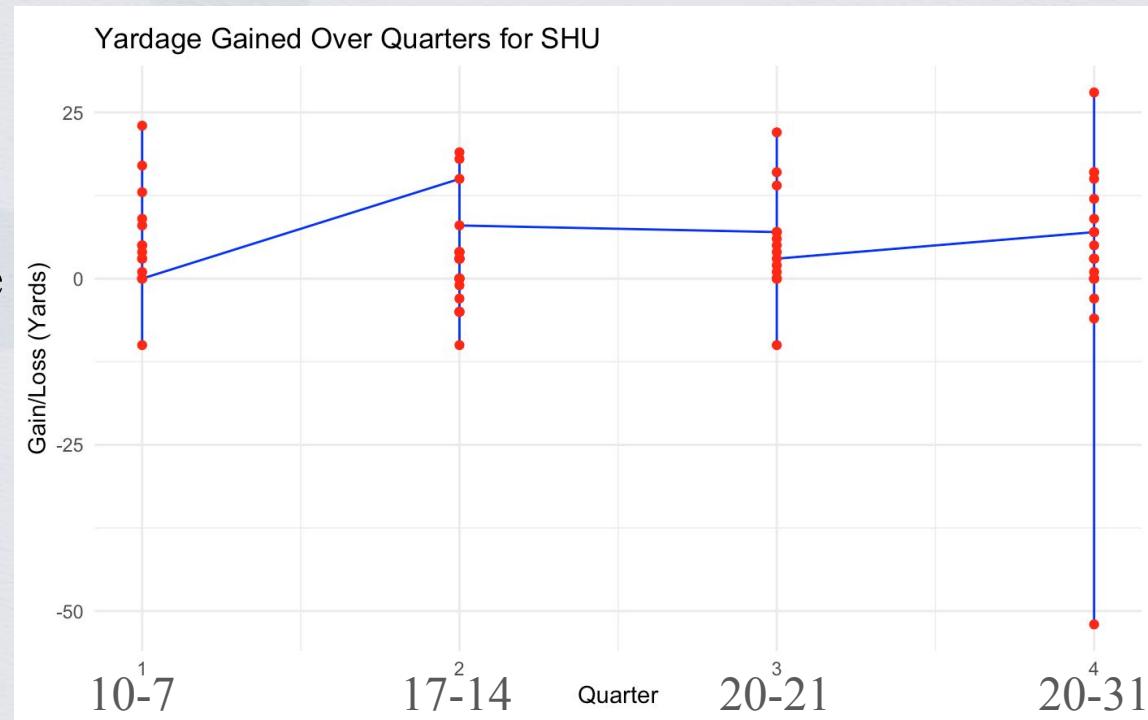




# Game Breakdown: Sacred Heart

**Task #10:** Display the Yardage Gained/Lost in Each Quarter

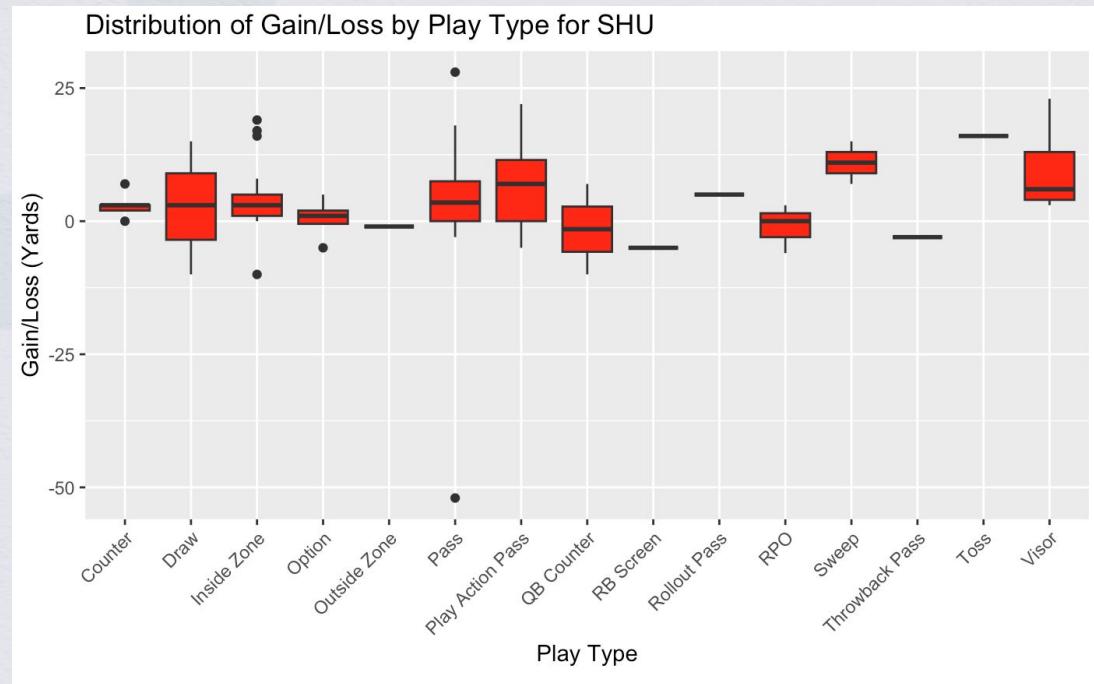
**Score:** (Merrimack - Sacred Heart)





# Game Breakdown: Sacred Heart

**Task #11:** Visualize the Average Gain/Loss by Play Type, Along with Their Frequency





# Game Breakdown: Fordham



VS.





# Game Breakdown: Fordham

## Task #1: Play Type Distribution

Play_Type <fctr>	Frequency <int>
Pass	17
RPO	13
Pin/Pull	8
Inside Zone	5
Sweep	5
Visor	3
Counter	2
Option	2
Play Action Pass	2
Double Visor	1
Fake Reverse	1
Kneel	1
Reverse	1
Rollout Pass	1
Toss	1
WR Screen	1
Y Screen	1



# Game Breakdown: Fordham

**Task #2:** Personnel Distribution

<b>Personnel</b> <i>&lt;int&gt;</i>	<b>Frequency</b> <i>&lt;int&gt;</i>
11	38
12	17
10	7
22	3



# Game Breakdown: Fordham

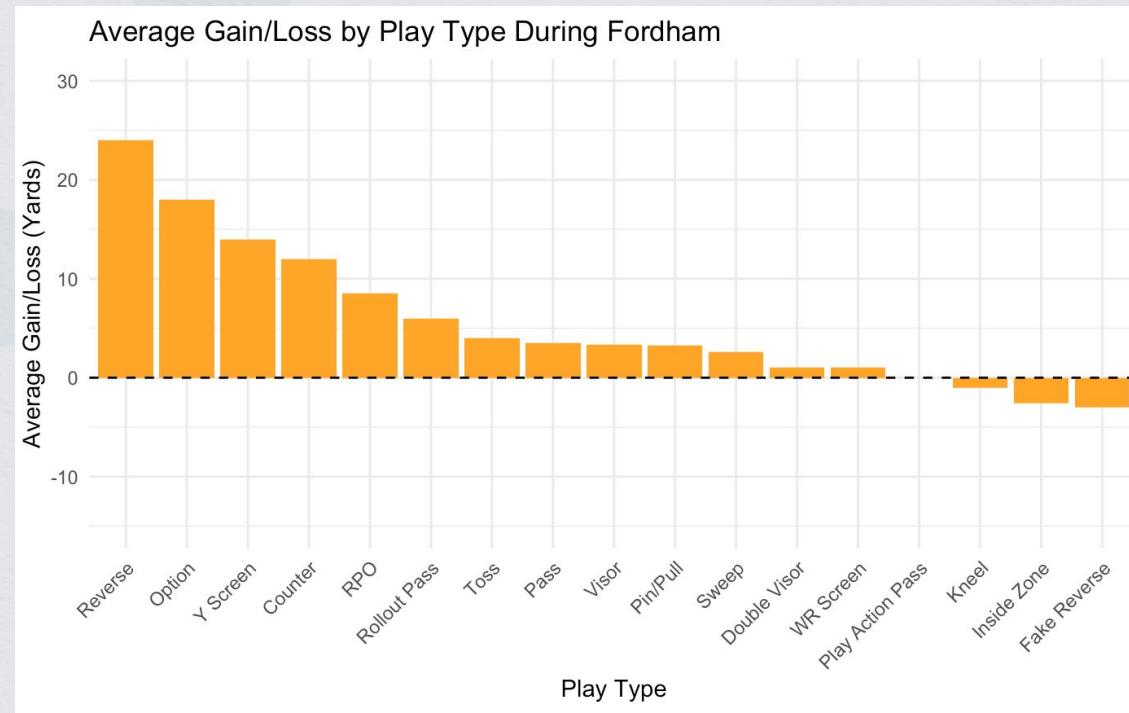
**Task #3:** Average Gain/Loss by Play Type

Play_Type <fctr>	Average_Gain_Loss <dbl>
Reverse	24.000000
Option	18.000000
Y Screen	14.000000
Counter	12.000000
RPO	8.538462
Rollout Pass	6.000000
Toss	4.000000
Pass	3.529412
Visor	3.333333
Pin/Pull	3.250000
Sweep	2.600000
Double Visor	1.000000
WR Screen	1.000000
Play Action Pass	0.000000
Kneel	-1.000000
Inside Zone	-2.600000
Fake Reverse	-3.000000



# Game Breakdown: Fordham

**Task #4:** Average Gain/Loss by Play Type Visualization





# Game Breakdown: Fordham

**Task #5:** Average Gain/Loss by Play Type During 2 Minute Drill

**Score:** 9 (Merrimack) - 3 (Fordham)

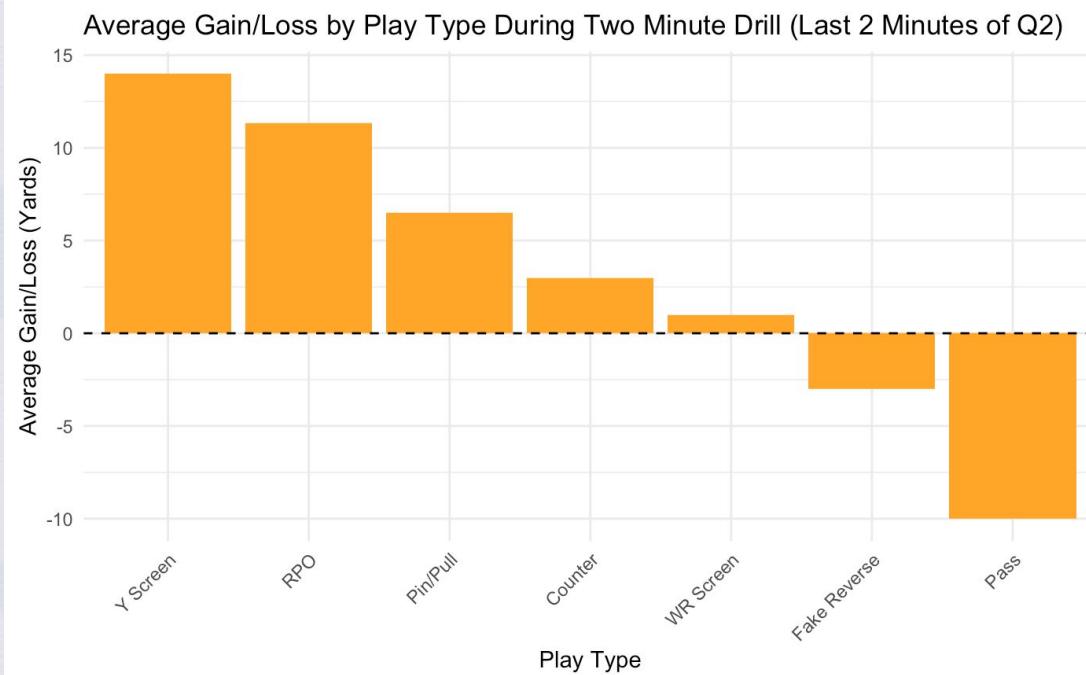
Play_Type <fctr>	Average_Gain_Loss <dbl>
Y Screen	14.00000
RPO	11.33333
Pin/Pull	6.50000
Counter	3.00000
WR Screen	1.00000
Fake Reverse	-3.00000
Pass	-10.00000



# Game Breakdown: Fordham

**Task #6:** Average Gain/Loss by Play Type During 2 Minute Drill Visualization

**Score:** 9 (Merrimack) - 3 (Fordham)





# Game Breakdown: Fordham

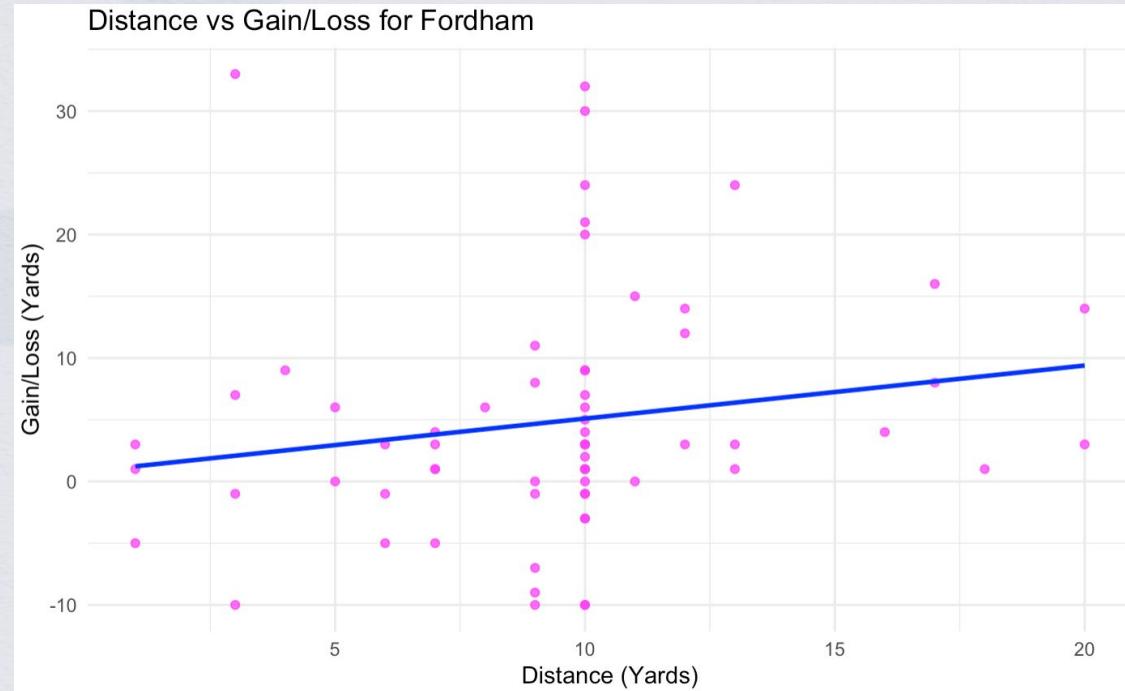
Task #7: Identify the Penalties

Penalty_Type	n
<chr>	<int>
Holding	4
Illegal Man Downfield	1
Offensive Pass Interference	1
Offsides	1



# Game Breakdown: Fordham

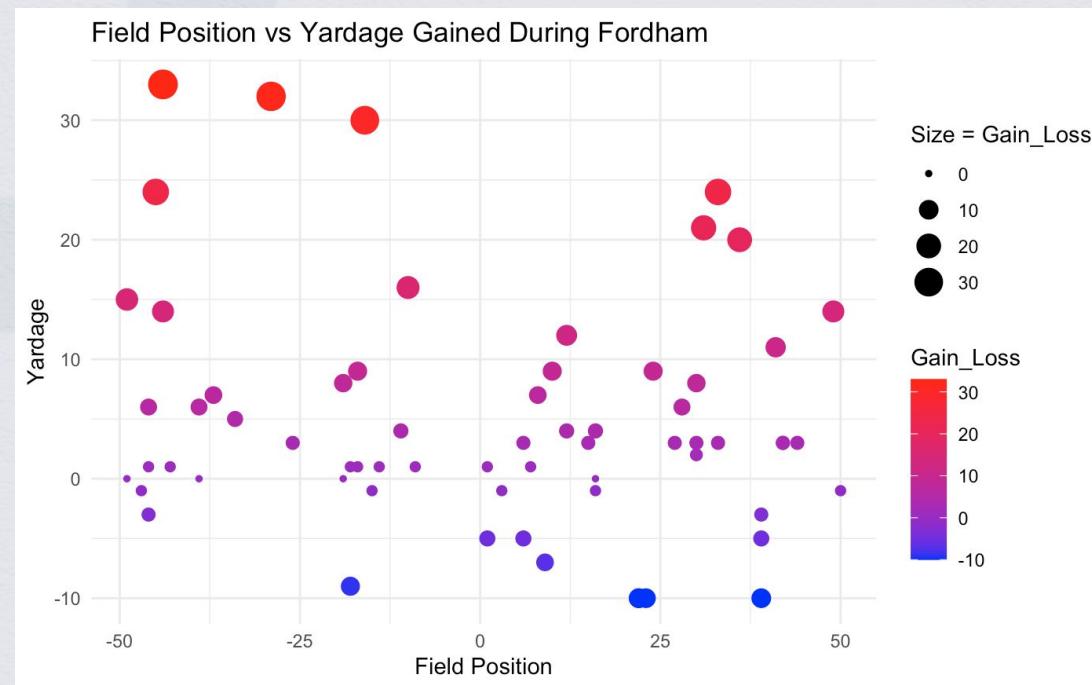
**Task #8:** Display the Distance vs. Gain/Loss throughout the game





# Game Breakdown: Fordham

**Task #9:** Display the Gain/Loss vs. Field Position throughout the game

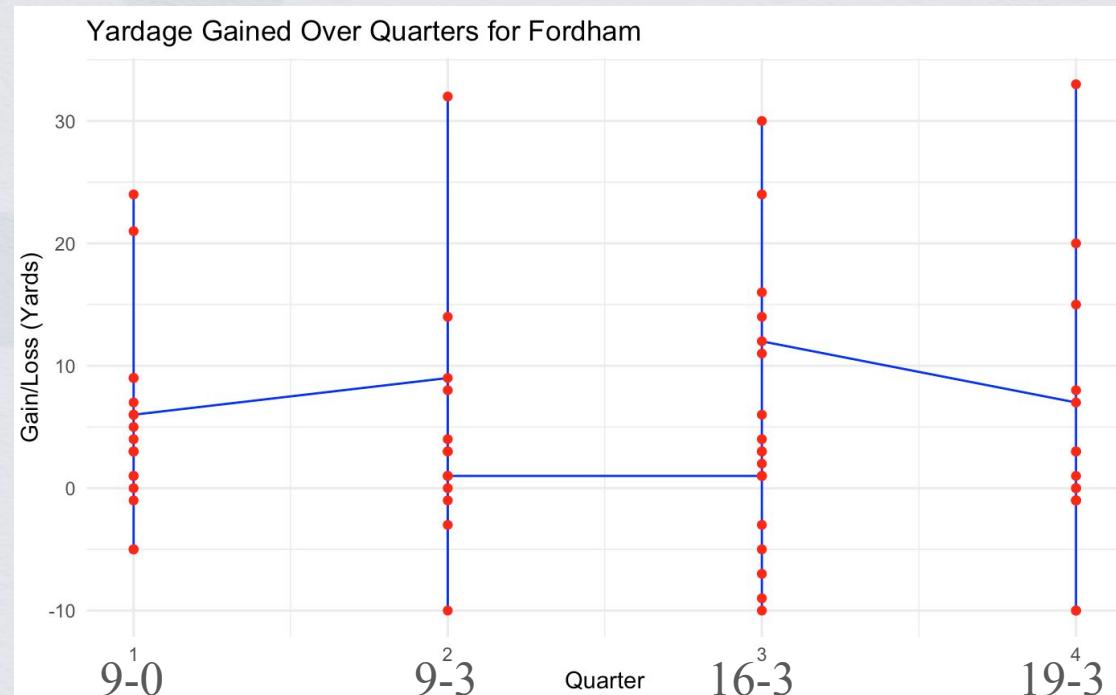




# Game Breakdown: Fordham

## Task #10: Display the Yardage Gained/Lost in Each Quarter

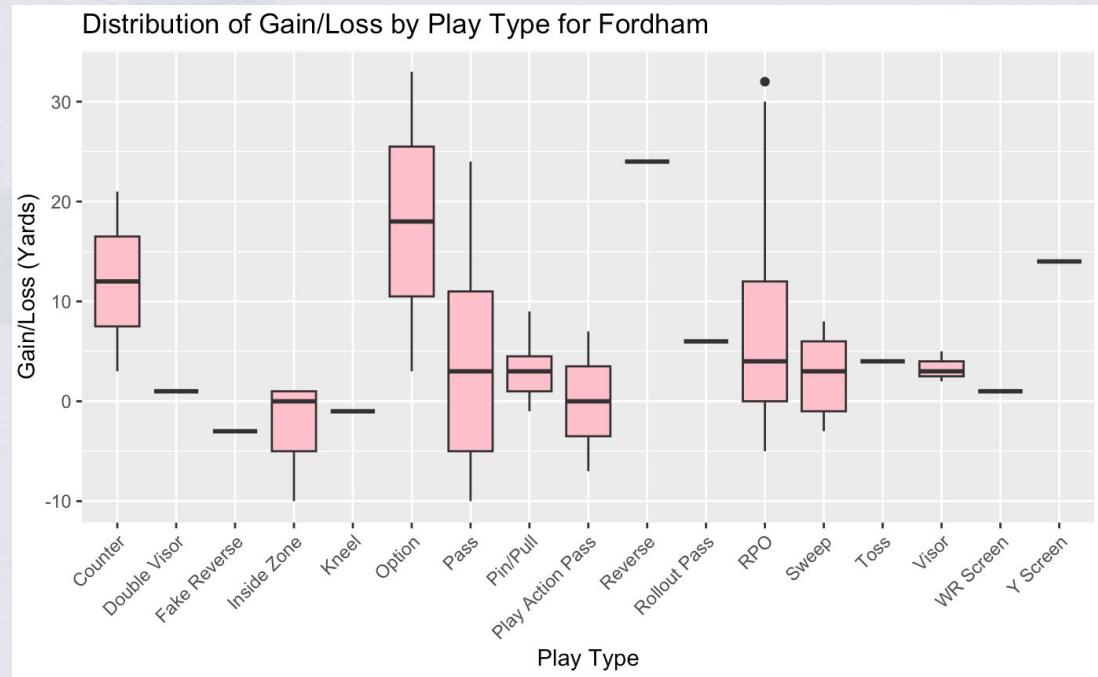
**Score:** (Merrimack - Fordham)





# Game Breakdown: Fordham

**Task #11:** Visualize the Average Gain/Loss by Play Type, Along with Their Frequency





# Conclusions

## Key Takeaways:

- Each Game = Different Game Plan
- Eliminating Penalties = More Success
- Plays Work Differently, Given The Situation

Colgate:

Play_Type <fctr>	Average_Gain_Loss <dbl>
RB Screen	25.0000000

Stonehill:

RB Screen	-5.000000
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# Recommendations / Further Work

- By Acquiring Data Like This Every Year, Certain Trends Would Show Up For Different Teams
- With More Data, Predictive Modeling Can Be Used To Predict Outcomes Of Games Based On Historical Data



**Thank You!**

**Questions?**