Fantasy Football Optimization

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Dataset

The dataset consists of 920 players and 32 teams.

- There are 6 positions {QB, RB, WR, TE, K, DEF}
- The data has a linear pattern (minus those whose price=1)


```
Regression Equations by Position:
QB: y = 1.84x + 242.38
RB: y = 1.74x + 106.35
WR: y = 1.82x + 95.18
TE: y = 2.10x + 76.20
K: y = 2.58x + 124.10
DEF: y = 2.94x + 105.31
```
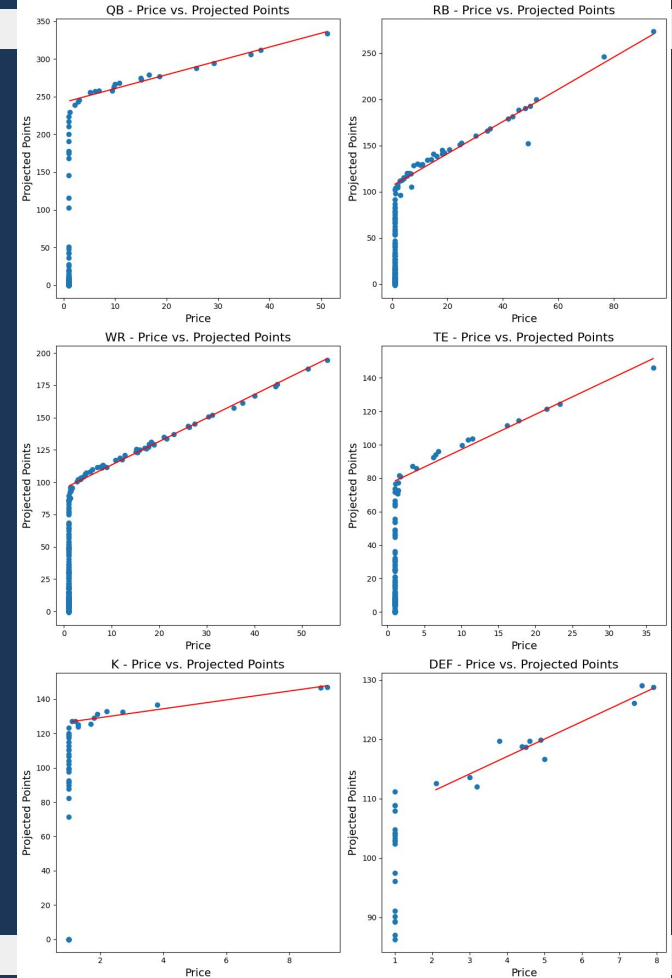
Bad Model Variables/Constraints

```
[64] # Create variables
     starter_vars = [bad_solver.BoolVar(name + '_starter') for name in name_list]
     bench_vars = [bad_solver.BoolVar(name + '_bench') for name in name_list]

     print(bad_solver.NumVariables())

     1904
```

```
[65] # Starters
     bad_solver.Add(sum(starter_vars[i] for i in range(num_players) if position_list[i] == 'QB') == 1)
     bad_solver.Add(sum(starter_vars[i] for i in range(num_players) if position_list[i] == 'RB') == 2)
     bad_solver.Add(sum(starter_vars[i] for i in range(num_players) if position_list[i] == 'WR') == 3)
     bad_solver.Add(sum(starter_vars[i] for i in range(num_players) if position_list[i] == 'TE') == 1)
     bad_solver.Add(sum(starter_vars[i] for i in range(num_players) if position_list[i] == 'K') == 1)
     bad_solver.Add(sum(starter_vars[i] for i in range(num_players) if position_list[i] == 'DEF') == 1)

     <ortools.linear_solver.pywraplp.Constraint; proxy of <Swig Object of type 'operations_research::MPConstraint *' at 0x787348b2de90> >
```

```
[66] # Bench
     bad_solver.Add(sum(bench_vars[i] for i in range(num_players) if position_list[i] == 'QB') <= 1)
     bad_solver.Add(sum(bench_vars[i] for i in range(num_players) if position_list[i] == 'TE') <= 1)
     bad_solver.Add(sum(bench_vars[i] for i in range(num_players) if position_list[i] == 'K') == 0)
     bad_solver.Add(sum(bench_vars[i] for i in range(num_players) if position_list[i] == 'DEF') == 0)

     <ortools.linear_solver.pywraplp.Constraint; proxy of <Swig Object of type 'operations_research::MPConstraint *' at 0x787348b2dce0> >
```

```
# Limits each player to one list
for starter, bench in zip(starter_vars, bench_vars):
    bad_solver.Add(starter + bench <= 1)

# 9 Starters and 6 Bench Players
bad_solver.Add(sum(starter_vars) == 9)  # Total starters: 1 QB, 3 WR, 2 RB, 1 TE, 1 K, 1 DEF
bad_solver.Add(sum(bench_vars) == 6)  # Total bench players

# Budget Constraint
bad_solver.Add(sum(price_list[i] * (starter_vars[i] + bench_vars[i]) for i in range(num_players)) <= 200)
print(bad_solver.NumConstraints())

965
```

Bad Model Optimization/Results

```
[68] bad_solver.Maximize(
        sum(projected_points_list[i] * starter_vars[i] for i in range(num_players))  # Full points for starters
        + sum(projected_points_list[i] * 0.5 * bench_vars[i] for i in range(num_players))  # Half points for bench players
    )
```

Player	Position	Proj Points	Proj Points/$	Contrib Points	Contrib Points/$	Price	Depth
Cam Newton	QB	278.8	16.8	278.8	16.8	16.6	starter
Tyrod Taylor	QB	255.8	50.16	127.9	25.08	5.1	bench
Ty Montgomery	RB	140.9	9.46	140.9	9.46	14.9	starter
C.J. Anderson	RB	128.8	16.3	128.8	16.3	7.9	starter
Terrance West	RB	120.1	21.84	60.05	10.92	5.5	bench
Spencer Ware	RB	115.5	26.86	57.75	13.43	4.3	bench
Matt Forte	RB	112.2	32.06	56.1	16.03	3.5	bench
Jonathan Stewart	RB	111.7	38.52	55.85	19.26	2.9	bench
Danny Woodhead	RB	107.0	53.5	53.5	26.75	2.0	bench
Julio Jones	WR	187.8	3.66	187.8	3.66	51.3	starter
Michael Crabtree	WR	130.9	7.15	130.9	7.15	18.3	starter
Emmanuel Sanders	WR	125.7	8.27	125.7	8.27	15.2	starter
Stephen Gostkowski	K	146.6	16.29	146.6	16.29	9.0	starter
Rob Gronkowski	TE	146.0	4.07	146.0	4.07	35.9	starter
Denver Broncos	DEF	129.0	16.97	129.0	16.97	7.6	starter

Total projected points contributed: 1825.65
Total team cost: 200.0

Good Model Variables/Constraints

```
[74] # Create variables for each depth level
     depth1_vars = [solver.BoolVar(name + '_depth1') for name in name_list]  # Starters
     depth2_vars = [solver.BoolVar(name + '_depth2') for name in name_list]  # Bench Depth 2
     depth3_vars = [solver.BoolVar(name + '_depth3') for name in name_list]  # Bench Depth 3
     depth4_vars = [solver.BoolVar(name + '_depth4') for name in name_list]  # Bench Depth 4
     print(solver.NumVariables())

     3808
```

```
[75] # Position constraints for each depth
     # Depth 1 (Starters)
     solver.Add(sum(depth1_vars[i] for i in range(num_players) if position_list[i] == 'QB') == 1)
     solver.Add(sum(depth1_vars[i] for i in range(num_players) if position_list[i] == 'RB') == 2)
     solver.Add(sum(depth1_vars[i] for i in range(num_players) if position_list[i] == 'WR') == 3)
     solver.Add(sum(depth1_vars[i] for i in range(num_players) if position_list[i] == 'TE') == 1)
     solver.Add(sum(depth1_vars[i] for i in range(num_players) if position_list[i] == 'K') == 1)
     solver.Add(sum(depth1_vars[i] for i in range(num_players) if position_list[i] == 'DEF') == 1)

     # Depth 2
     solver.Add(sum(depth2_vars[i] for i in range(num_players) if position_list[i] == 'QB') <= 1)
     solver.Add(sum(depth2_vars[i] for i in range(num_players) if position_list[i] == 'RB') <= 1)
     solver.Add(sum(depth2_vars[i] for i in range(num_players) if position_list[i] == 'WR') <= 1)
     solver.Add(sum(depth2_vars[i] for i in range(num_players) if position_list[i] == 'TE') <= 1)
     solver.Add(sum(depth2_vars[i] for i in range(num_players) if position_list[i] == 'K') == 0)
     solver.Add(sum(depth2_vars[i] for i in range(num_players) if position_list[i] == 'DEF') ==0)

     # Depth 3
     solver.Add(sum(depth3_vars[i] for i in range(num_players) if position_list[i] == 'QB') == 0)
     solver.Add(sum(depth3_vars[i] for i in range(num_players) if position_list[i] == 'RB') <= 1)
     solver.Add(sum(depth3_vars[i] for i in range(num_players) if position_list[i] == 'WR') <= 1)
     solver.Add(sum(depth3_vars[i] for i in range(num_players) if position_list[i] == 'TE') == 0)
     solver.Add(sum(depth3_vars[i] for i in range(num_players) if position_list[i] == 'K') == 0)
     solver.Add(sum(depth3_vars[i] for i in range(num_players) if position_list[i] == 'DEF') ==0)

     # Depth 4
     solver.Add(sum(depth4_vars[i] for i in range(num_players) if position_list[i] == 'QB') == 0)
     solver.Add(sum(depth4_vars[i] for i in range(num_players) if position_list[i] == 'RB') <= 1)
     solver.Add(sum(depth4_vars[i] for i in range(num_players) if position_list[i] == 'WR') <= 1)
     solver.Add(sum(depth4_vars[i] for i in range(num_players) if position_list[i] == 'TE') == 0)
     solver.Add(sum(depth4_vars[i] for i in range(num_players) if position_list[i] == 'K') == 0)
     solver.Add(sum(depth4_vars[i] for i in range(num_players) if position_list[i] == 'DEF') ==0)

     <ortools.linear_solver.pywraplp.Constraint; proxy of <Swig Object of type 'operations_research::MPConstraint *' at 0x78734d9973c0> >
```

```
[76] # One depth per player
     for i in range(num_players):
         solver.Add(depth1_vars[i] + depth2_vars[i] + depth3_vars[i] + depth4_vars[i] <= 1)

     # Roster size constraint
     solver.Add(sum(depth1_vars) == 9)  # 9 Starters
     solver.Add(sum(depth2_vars) + sum(depth3_vars) + sum(depth4_vars) == 6)  # 6 Bench players

     # Budget constraint
     solver.Add(sum(price_list[i] * (depth1_vars[i] + depth2_vars[i] + depth3_vars[i] + depth4_vars[i]) for i in range(num_players)) <= 200)
     print(solver.NumConstraints())

     979
```

Good Model

Optimization/Results

```
[77] # Objective function
     solver.Maximize(
         sum(projected_points_list[i] * depth1_vars[i] for i in range(num_players))  # Full points for starters
         + sum(projected_points_list[i] * 0.5 * depth2_vars[i] for i in range(num_players))  # Half points for depth 2
         + sum(projected_points_list[i] * 0.25 * depth3_vars[i] for i in range(num_players))  # Quarter points for depth 3
         + sum(projected_points_list[i] * 0.125 * depth4_vars[i] for i in range(num_players))  # One eighth points for depth 4
     )
```

```
Optimal solution found.

Player              Position   Proj Points   Proj Points/$   Contrib Points   Contrib Points/$   Price   Depth
Cam Newton          QB         278.8         16.8            278.8            16.8               16.6    1
Tyrod Taylor        QB         255.8         50.16           127.9            25.08              5.1     2
Ty Montgomery       RB         140.9         9.46            140.9            9.46               14.9    1
C.J. Anderson       RB         128.8         16.3            128.8            16.3               7.9     1
Jonathan Stewart    RB         111.7         38.52           55.85            19.26              2.9     2
Theo Riddick        RB         104.2         80.15           26.05            20.04              1.3     3
Antonio Brown       WR         194.6         3.52            194.6            3.52               55.3    1
Julio Jones         WR         187.8         3.66            187.8            3.66               51.3    1
Emmanuel Sanders    WR         125.7         8.27            125.7            8.27               15.2    1
Rishard Matthews    WR         102.3         35.28           51.15            17.64              2.9     2
John Brown          WR         95.8          73.69           23.95            18.42              1.3     3
Justin Tucker       K          147.0         15.98           147.0            15.98              9.2     1
Martellus Bennett   TE         95.9          13.9            95.9             13.9               6.9     1
Coby Fleener        TE         81.7          51.06           40.85            25.53              1.6     2
Denver Broncos      DEF        129.0         16.97           129.0            16.97              7.6     1

Total projected points contributed: 1754.2500000000002
Total team cost: 200.0
```

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Who would you choose to maximize points while staying in budget?

How many points does you team expect to generate?

How much of your budget did you spend?

Cam Newton	QB
Tyrod Taylor	QB
Ty Montgomery	RB
C.J. Anderson	RB
Jonathan Stewart	RB
Theo Riddick	RB
Antonio Brown	WR
Julio Jones	WR
Emmanuel Sanders	WR
Rishard Matthews	WR
John Brown	WR
Justin Tucker	K
Martellus Bennett	TE
Coby Fleener	TE
Denver Broncos	DEF

1754.25

All $200