

# STAT380 Final Project

Andrew Eross, Owen Wassel, Jack Messina, Khang Le

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## Front Matter

```
remove(list = ls())
library(tidyverse)

## -- Attaching core tidyverse packages ----- tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## vforcats   1.0.0     v stringr   1.5.1
## v ggplot2   3.5.1     v tibble    3.2.1
## v lubridate 1.9.4     v tidyv     1.3.1
## v purrr     1.0.2

## -- Conflicts ----- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()   masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
library(caret)

## Loading required package: lattice
##
## Attaching package: 'caret'
##
## The following object is masked from 'package:purrr':
## 
##     lift
library(pROC)

## Type 'citation("pROC")' for a citation.
##
## Attaching package: 'pROC'
##
## The following objects are masked from 'package:stats':
## 
##     cov, smooth, var

library(ggplot2)
library(dplyr)
library(readxl)
library(lubridate)
library(FNN)
library(xgboost)

## 
## Attaching package: 'xgboost'
```

```

##  

## The following object is masked from 'package:dplyr':  

##  

##     slice

```

## Read in Datasets

```

CODGameModes <- read.csv("~/Documents/GitHub/stat380finalproject/CODGameModes.csv")
CODGames1 <- read.csv("~/Documents/GitHub/stat380finalproject/CODGames_p1_380.csv")
CODGames2 <- read.csv("~/Documents/GitHub/stat380finalproject/CODGames_p2_380.csv")

```

## Task 1

### Combine Player 1 and Player 2 Data

```

dim(CODGames1)

## [1] 589 27

dim(CODGames2)

## [1] 250 27

head(CODGames1)

##          Map1      Map2      Choice MapVote Date FullPartial
## 1      Moscow Miami Strike    Miami Strike 5 to 0 6/6/22      Full
## 2      Moscow           WMD      Moscow   2 to 0 6/6/22      Full
## 3                   Yamantau      6/6/22      Full
## 4      Drive-In     Jungle     Drive-In  2 to 0 6/6/22      Full
## 5 Collateral Strike Hijacked Collateral Strike 3 to 3 6/6/22      Full
## 6 Crossroads Strike       Raid        Raid 4 to 3 6/6/22      Full
##   Result Eliminations Deaths Score Damage TotalXP PrimaryWeapon XPType
## 1 100-97            22     17  4070    634  11002        M16 10% Boost
## 2 76-89             20     15  5305    560  9451        M16 10% Boost
## 3 100-92            18     11  3335    483 12948        M16 10% Boost
## 4 80-100            10     19  2170    280 11502        M16 Double XP + 10%
## 5 71-100            11     19  2195    308 11133        M16 Double XP + 10%
## 6 85-100             7     18   850    196 10077        M16 Double XP + 10%
##   DidPlayerVote GameType Confirms Denies Objectives ObjectiveKills Captures
## 1           No HC - TDM      NA      NA       NA        NA        NA
## 2           No HC - TDM      NA      NA       NA        NA        NA
## 3           No HC - TDM      NA      NA       NA        NA        NA
## 4           No HC - TDM      NA      NA       NA        NA        NA
## 5           No HC - TDM      NA      NA       NA        NA        NA
## 6           No HC - TDM      NA      NA       NA        NA        NA
##   Diffuses Plants Detonates Deposits Time_Sec Time_Min
## 1       NA     NA       NA      NA       NA       NA
## 2       NA     NA       NA      NA       NA       NA
## 3       NA     NA       NA      NA       NA       NA
## 4       NA     NA       NA      NA       NA       NA
## 5       NA     NA       NA      NA       NA       NA
## 6       NA     NA       NA      NA       NA       NA

head(CODGameModes)

```

```

##          Mode ScoreLimit TimeLimit
## 1      Domination        200      None
## 2 Kill Confirmed         65 10 Minutes
## 3     Hardpoint        250 5 Minutes
## 4           TDM        100 10 Minutes

# Add a Player ID and stack both datasets

games_all <- bind_rows(
  CODGames1 %>% mutate(Player = "Player1"),
  CODGames2 %>% mutate(Player = "Player2")
)

dim(games_all)

## [1] 839 28

head(games_all)

##          Map1      Map2      Choice MapVote Date FullPartial
## 1      Moscow Miami Strike Miami Strike 5 to 0 6/6/22    Full
## 2      Moscow       WMD      Moscow 2 to 0 6/6/22    Full
## 3                   Yamantau      6/6/22    Full
## 4     Drive-In     Jungle Drive-In 2 to 0 6/6/22    Full
## 5 Collateral Strike Hijacked Collateral Strike 3 to 3 6/6/22    Full
## 6 Crossroads Strike       Raid       Raid 4 to 3 6/6/22    Full
##   Result Eliminations Deaths Score Damage TotalXP PrimaryWeapon XPType
## 1 100-97            22     17  4070    634  11002        M16 10% Boost
## 2 76-89             20     15  5305    560   9451        M16 10% Boost
## 3 100-92            18     11  3335    483  12948        M16 10% Boost
## 4 80-100            10     19  2170    280  11502        M16 Double XP + 10%
## 5 71-100            11     19  2195    308  11133        M16 Double XP + 10%
## 6 85-100            7      18   850    196  10077        M16 Double XP + 10%
##   DidPlayerVote GameType Confirms Denies Objectives ObjectiveKills Captures
## 1           No HC - TDM      NA      NA      NA        NA      NA
## 2           No HC - TDM      NA      NA      NA        NA      NA
## 3           No HC - TDM      NA      NA      NA        NA      NA
## 4           No HC - TDM      NA      NA      NA        NA      NA
## 5           No HC - TDM      NA      NA      NA        NA      NA
## 6           No HC - TDM      NA      NA      NA        NA      NA
##   Diffuses Plants Detonates Deposits Time_Sec Time_Min Player
## 1        NA    NA      NA      NA      NA      NA Player1
## 2        NA    NA      NA      NA      NA      NA Player1
## 3        NA    NA      NA      NA      NA      NA Player1
## 4        NA    NA      NA      NA      NA      NA Player1
## 5        NA    NA      NA      NA      NA      NA Player1
## 6        NA    NA      NA      NA      NA      NA Player1

```

Clean GameType (merge HC variants with base modes)

```

# Look at raw GameType values

unique(games_all$GameType)

## [1] "HC - TDM"          "HC - Kill Confirmed" "HC - Hardpoint"
## [4] "HC - Domination"   "TDM"                  "Hardpoint"

```

```

## [7] "Kill Confirmed"      "Domination"
# Remove "HC -", "HC -", etc. and map hardcore versions to base mode

games_all <- games_all %>%
  mutate(
    GameType_clean = stringr::str_replace(
      GameType,
      "HC[:space:]*[--][:space:]*",
      ""
    )
  )

unique(games_all$GameType_clean)

## [1] "TDM"           "Kill Confirmed" "Hardpoint"     "Domination"

```

Join with CODGameModes to bring in ScoreLimit and TimeLimit

```

games_split <- games_all %>%
  # Join with game mode metadata
  left_join(CODGameModes, by = c("GameType_clean" = "Mode")) %>%

  # Split Result into team & opponent scores
  separate(Result, into = c("TeamScore", "OpponentScore"),
            sep = "-", remove = FALSE) %>%

  mutate(
    TeamScore = as.numeric(TeamScore),
    OpponentScore = as.numeric(OpponentScore)
  )

```

```

## Warning: Expected 2 pieces. Missing pieces filled with `NA` in 31 rows [221, 232, 240,
## 247, 257, 263, 266, 270, 283, 292, 298, 312, 326, 330, 351, 354, 403, 417, 423,
## 433, ...].

```

Create indicator: did the match reach the score limit?

```

# Create a logical/0-1 variable for reaching the score limit
games_split <- games_split %>%
  mutate(
    ReachedLimit = ifelse(TeamScore == ScoreLimit, 1, 0)
  )

# Sanity check

table(games_split$ReachedLimit, useNA = "ifany")

##
##      0      1 <NA>
## 414   394    31

```

Summarize: proportion of matches that reach the score limit by game mode

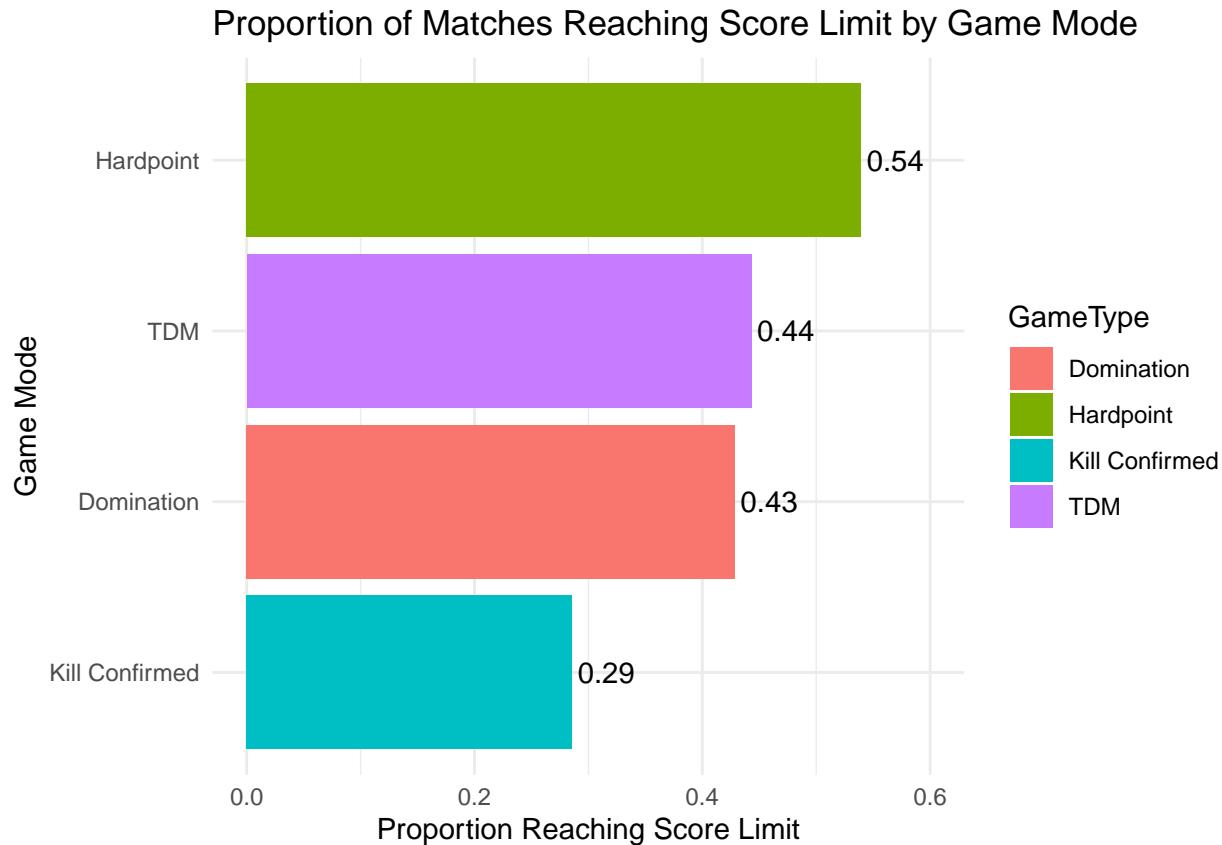
```
limit_summary <- games_split %>%
  group_by(GameType_clean) %>%
  summarise(
    TotalMatches = n(),
    ScoreReached = sum(ReachedLimit, na.rm = TRUE),
    ProportionScoreReached = ScoreReached / TotalMatches
  ) %>%
  rename(GameType = GameType_clean) %>%
  arrange(desc(ProportionScoreReached))

limit_summary

## # A tibble: 4 x 4
##   GameType     TotalMatches ScoreReached ProportionScoreReached
##   <chr>          <int>        <dbl>                  <dbl>
## 1 Hardpoint      267         144                  0.539
## 2 TDM            537         238                  0.443
## 3 Domination     14          6                   0.429
## 4 Kill Confirmed 21          6                   0.286
```

Visualization: bar plot of proportion reaching score limit

```
ggplot(limit_summary,
aes(x = reorder(GameType, ProportionScoreReached),
y = ProportionScoreReached, fill = GameType)) +
geom_text(aes(label = round(ProportionScoreReached, 2)), hjust = -0.1) +
geom_col() +
ylim(0,.6) +
coord_flip() +
labs(
  title = "Proportion of Matches Reaching Score Limit by Game Mode",
  x = "Game Mode",
  y = "Proportion Reaching Score Limit"
) +
theme_minimal()
```



## Task 2

```

# Scale TotalXP based on XPType and remove partial games
scaled_games_split <- games_split %>%
  mutate(ScaledXP = ifelse(XPType == "10% Boost", TotalXP / 1.1, TotalXP / 2.1)) %>%
  filter(FullPartial == "Full")

# Select numeric predictors.
numeric_vars <- scaled_games_split %>% select(where(is.numeric), -TotalXP, -ScoreLimit)

# Keep numeric variables with at least 50% non-missing values.
numeric_vars <- numeric_vars[, colMeans(!is.na(numeric_vars)) > 0.50]

# Build modeling dataset containing TotalXP and usable numeric predictors.
model_data <- scaled_games_split %>% select(ScaledXP, all_of(colnames(numeric_vars))) %>% drop_na()

model_data

##      ScaledXP TeamScore OpponentScore Eliminations Deaths Score Damage
## 1 10001.818      100          97        22     17  4070   634
## 2  8591.818       76          89        20     15  5305   560
## 3 11770.909      100          92        18     11  3335   483
## 4  5477.143       80          100       10     19  2170   280
## 5  5301.429       71          100       11     19  2195   308
## 6  4798.571       85          100        7     18   850   196
## 7  7751.818       86          100       10     21  2240   259

```

## 8	7953.810	100	70	18	14	3505	504
## 9	9458.182	46	65	11	23	1985	304
## 10	8650.909	47	65	23	12	3400	617
## 11	8893.636	100	94	10	11	1460	306
## 12	5950.000	100	90	11	20	1550	332
## 13	8437.273	100	77	17	12	3765	476
## 14	7743.636	100	98	14	12	2910	371
## 15	9471.818	250	210	14	34	2025	392
## 16	7698.182	250	207	13	42	2045	359
## 17	7695.455	250	143	7	17	1550	192
## 18	4943.636	250	54	10	15	1760	224
## 19	10732.727	214	250	19	26	3260	502
## 20	6611.818	100	99	13	12	1915	344
## 21	8217.273	77	98	17	13	3490	461
## 22	4355.455	53	62	5	13	650	140
## 23	12523.636	100	96	15	15	3615	377
## 24	6595.455	89	100	13	16	2630	363
## 25	5961.818	88	100	13	18	2695	359
## 26	8332.727	88	82	17	18	3120	461
## 27	12645.455	100	54	20	12	3650	490
## 28	4384.286	65	100	8	16	1100	203
## 29	6518.095	100	92	12	16	2650	335
## 30	10268.571	100	96	18	9	3350	504
## 31	6585.714	117	200	21	26	3290	593
## 32	8036.190	140	200	16	18	3250	429
## 33	10536.190	200	200	19	20	3550	549
## 34	6162.857	74	100	18	14	5295	493
## 35	7193.333	71	100	20	18	3290	552
## 36	4668.571	71	100	8	15	1450	207
## 37	6563.810	100	94	12	17	1615	383
## 38	6377.619	100	75	22	13	4250	616
## 39	7472.381	70	100	15	17	3350	407
## 40	8358.571	81	100	10	24	1000	292
## 41	8420.476	100	96	16	15	2670	448
## 42	5463.333	97	100	13	12	1970	404
## 43	9542.857	100	92	23	15	4305	668
## 44	4790.952	91	100	8	13	1380	224
## 45	4177.143	78	100	12	12	2665	356
## 46	7040.476	100	93	21	21	3540	635
## 47	6323.333	100	78	13	13	2310	343
## 48	8298.571	100	75	14	15	3215	392
## 49	7490.000	100	84	14	14	2425	378
## 50	9974.286	100	99	19	15	3705	532
## 51	4912.857	97	100	16	9	2770	448
## 52	7591.905	87	100	23	13	5950	592
## 53	6858.571	100	61	10	10	2905	280
## 54	5687.619	100	95	6	17	1330	168
## 55	6064.286	96	100	15	11	3315	416
## 56	16021.429	100	93	24	10	6150	654
## 57	5802.727	83	100	12	19	2110	280
## 58	4600.000	100	76	19	10	2695	532
## 59	10791.429	93	100	27	10	6110	755
## 60	6087.143	59	100	9	19	1505	290
## 61	5689.048	100	70	8	13	1070	224

## 62	6352.857	67	100	13	16	2650	364
## 63	5634.762	79	95	20	8	5405	552
## 64	8369.524	100	74	14	15	2210	392
## 65	10496.364	100	87	14	10	2420	435
## 66	6359.091	100	80	13	8	2910	412
## 67	5217.273	85	100	12	17	1820	313
## 68	6509.091	100	70	12	12	2930	332
## 69	3450.000	79	100	4	16	500	121
## 70	8904.545	100	51	27	8	5110	746
## 71	10021.818	75	100	13	14	2825	415
## 72	7066.364	100	56	19	12	2720	507
## 73	12569.048	100	99	22	11	4725	621
## 74	7816.364	97	100	13	15	1540	388
## 75	7362.727	80	91	15	18	3175	509
## 76	5102.727	52	100	13	21	2005	342
## 77	6419.048	86	100	17	13	4620	475
## 78	7630.952	100	91	18	15	4115	551
## 79	10057.143	100	71	35	12	7235	960
## 80	10565.455	93	72	15	9	2240	411
## 81	6667.273	55	100	18	18	2645	517
## 82	5486.364	85	100	10	21	1675	280
## 83	6759.091	100	94	18	17	2780	504
## 84	8543.636	81	100	18	12	3100	454
## 85	7771.818	66	91	17	15	2735	452
## 86	5834.762	73	100	17	16	2475	492
## 87	15583.333	68	100	18	13	3480	469
## 88	17511.429	100	98	16	12	7200	448
## 89	7421.818	84	74	12	9	3245	336
## 90	8629.048	100	71	12	12	1980	336
## 91	9027.619	100	85	19	15	2685	531
## 92	7009.048	100	90	15	15	1865	396
## 93	6807.619	100	88	19	13	3590	525
## 94	5530.476	100	92	10	30	815	304
## 95	5375.238	78	100	14	12	3125	356
## 96	5176.190	72	100	14	20	2220	419
## 97	7226.190	66	85	12	21	2086	336
## 98	8374.545	100	83	22	14	2885	599
## 99	9919.091	92	84	14	13	3795	365
## 100	10212.727	77	100	12	21	1490	336
## 101	10922.727	100	92	24	15	5195	672
## 102	9060.000	92	100	18	16	4805	481
## 103	7820.909	84	100	12	13	2540	334
## 104	5544.545	58	100	15	12	3120	400
## 105	10677.273	100	86	27	17	6880	757
## 106	6711.818	69	100	21	12	7315	580
## 107	20864.762	100	68	29	14	5120	761
## 108	5933.636	100	93	13	18	2360	355
## 109	6757.273	79	100	15	23	2840	397
## 110	8481.818	65	100	13	18	2870	364
## 111	9421.818	100	94	18	15	2985	491
## 112	5580.000	100	85	14	14	2515	377
## 113	7950.000	83	100	15	11	3595	392
## 114	10472.727	100	63	26	15	5110	735
## 115	12220.000	87	99	18	18	2325	504

## 116	5958.182	76	100	15	19	2500	408
## 117	8350.000	100	90	14	14	3180	392
## 118	10001.818	100	65	16	12	3245	448
## 119	5073.636	85	100	9	15	1775	252
## 120	5305.455	100	72	11	17	1675	302
## 121	8751.818	95	100	15	14	2700	420
## 122	8974.545	81	100	14	18	2370	397
## 123	6548.182	64	100	16	17	2500	437
## 124	8387.273	100	88	27	11	4530	719
## 125	12422.857	100	98	23	24	3675	647
## 126	7597.273	51	100	17	15	3645	494
## 127	8038.571	77	87	18	10	4565	500
## 128	8102.857	100	60	12	12	2460	336
## 129	8271.429	100	78	17	17	2835	476
## 130	9416.190	100	83	27	14	5550	768
## 131	6582.857	90	100	11	25	2610	300
## 132	5957.273	60	99	10	21	1555	278
## 133	10000.000	94	70	19	10	3515	520
## 134	9564.762	100	88	27	15	4840	756
## 135	9508.095	99	99	23	19	3735	602
## 136	8923.333	73	97	13	21	2650	364
## 137	9958.095	100	77	18	10	4320	510
## 138	8544.762	100	55	24	11	5500	630
## 139	11354.545	100	83	22	12	4930	616
## 140	5958.182	100	83	10	17	1560	280
## 141	5290.000	100	93	9	15	1555	264
## 142	12444.545	100	69	21	6	4185	594
## 143	16831.429	75	100	18	15	7280	503
## 144	6248.182	87	100	10	19	2420	280
## 145	7645.455	100	84	17	11	3065	476
## 146	9995.455	250	94	7	18	1240	195
## 147	6545.455	112	250	22	20	2615	618
## 148	11127.273	226	250	39	32	4955	789
## 149	4534.545	100	91	4	16	550	120
## 150	3460.909	83	100	6	15	1205	139
## 151	7905.455	100	82	7	13	900	196
## 152	8873.636	87	100	16	16	3025	470
## 153	13208.182	100	90	19	15	4570	532
## 154	3747.273	63	100	5	15	1125	140
## 155	8289.091	74	100	12	22	1700	336
## 156	7213.636	100	85	18	15	3875	504
## 157	11722.727	100	96	17	17	3575	387
## 158	7586.364	100	90	10	23	1040	323
## 159	9300.000	100	85	25	13	4765	691
## 160	9828.182	100	79	14	15	2825	399
## 161	4828.182	56	100	8	16	1895	200
## 162	8263.636	53	100	10	16	2105	279
## 163	15300.909	100	62	26	12	6895	728
## 164	7109.048	100	66	18	14	3770	502
## 165	12499.091	100	86	21	19	4710	602
## 166	9389.091	99	100	14	14	3290	392
## 167	10552.857	95	96	22	21	3500	603
## 168	6100.476	90	100	13	21	2870	345
## 169	7367.619	100	86	11	17	2440	295

## 170	7498.571	94	100	10	24	1475	280
## 171	6413.810	91	57	8	17	700	224
## 172	9223.636	97	88	8	14	1480	224
## 173	14750.952	100	48	26	11	6480	706
## 174	11596.364	100	85	23	15	3150	599
## 175	11065.238	95	94	27	17	4560	737
## 176	7813.810	100	82	16	15	2945	426
## 177	8034.762	96	91	20	14	3385	560
## 178	9880.476	82	98	19	11	4360	532
## 179	8892.727	91	86	14	16	2490	358
## 180	9536.364	100	96	18	13	3125	457
## 181	8121.818	88	83	12	14	2215	284
## 182	9217.273	74	65	16	19	2630	403
## 183	12559.091	94	88	16	15	2905	458
## 184	7910.000	59	100	10	18	2080	253
## 185	6815.455	100	84	12	18	1160	303
## 186	8470.909	95	100	16	15	3485	424
## 187	14014.545	100	98	20	16	3425	506
## 188	6571.818	100	79	12	14	3195	335
## 189	6511.818	60	100	14	20	3125	363
## 190	11002.727	100	69	25	9	5710	670
## 191	7381.818	100	89	25	13	3880	765
## 192	7077.619	100	70	23	10	3235	3306
## 193	14782.857	100	96	16	16	2480	2611
## 194	7693.810	100	99	25	19	3185	3301
## 195	8035.238	100	77	22	14	4215	3215
## 196	13966.190	100	84	31	18	4415	4587
## 197	7234.762	97	100	17	17	2620	2466
## 198	7966.190	77	100	21	18	2405	3111
## 199	8136.190	100	73	25	14	2695	3319
## 200	7432.857	85	100	17	17	3140	2222
## 201	6398.571	93	100	14	16	1895	1677
## 202	8362.381	75	81	17	17	2930	2471
## 203	11744.762	59	100	17	18	3025	3068
## 204	8039.048	65	100	15	22	2730	2570
## 205	7614.762	98	250	20	20	3000	2597
## 206	6620.476	119	250	17	27	2125	2432
## 207	7938.571	171	250	22	26	2935	3770
## 208	11594.286	250	176	24	26	3355	3343
## 209	11908.571	212	250	29	24	4155	3951
## 210	7489.048	64	250	10	23	1845	1386
## 211	10872.381	250	215	31	34	3675	3301
## 212	6350.952	95	100	10	18	1710	1668
## 213	10974.762	88	85	15	12	2375	2000
## 214	7540.952	100	85	12	15	1300	1842
## 215	13663.810	100	99	28	17	6445	4072
## 216	7648.571	87	100	17	19	2485	2478
## 217	8014.286	100	75	26	13	3725	3028
## 218	9409.524	98	95	22	12	3600	3105
## 219	9650.476	79	100	20	13	2540	2956
## 220	7541.429	85	100	14	12	2775	2071
## 221	6839.524	55	100	16	15	2455	2670
## 222	4053.333	50	100	7	16	1210	1220
## 223	6304.286	81	91	12	20	800	1574

## 224	7982.381	100	63	16	9	1965	2085
## 225	7840.000	63	100	14	15	2180	2213
## 226	9889.048	100	94	23	20	3185	3496
## 227	8000.476	70	100	14	17	1850	1903
## 228	8675.238	100	96	17	12	3330	2183
## 229	9842.381	53	100	15	25	3945	2617
## 230	9466.190	91	100	20	16	3380	2856
## 231	4800.476	89	100	8	15	800	1415
## 232	5303.333	79	100	15	17	2865	2171
## 233	8183.333	61	100	10	23	1420	1425
## 234	8346.190	72	74	14	13	2950	2507
## 235	8125.238	100	60	22	10	3675	2999
## 236	4627.143	86	100	12	11	2370	1805
## 237	8516.667	69	100	14	17	2340	2098
## 238	6134.286	95	74	23	13	4390	3543
## 239	11720.000	100	65	31	13	5455	4304
## 240	8431.429	80	100	12	12	1610	1594
## 241	8666.667	90	100	19	17	3160	3280
## 242	9908.095	100	78	21	12	3980	2925
## 243	9837.619	100	79	17	9	3310	2522
## 244	5798.571	64	100	11	22	1660	1321
## 245	8089.524	100	51	11	10	2040	1452
## 246	10975.238	100	86	23	19	3895	3310
## 247	7728.095	100	90	12	15	1730	1868
## 248	8399.048	85	100	20	15	4395	2971
## 249	14089.048	99	96	24	15	4615	3499
## 250	11733.333	83	70	15	13	2860	2160
## 251	7002.381	100	78	16	16	2780	2260
## 252	8256.190	100	99	15	17	2475	2446
## 253	9794.286	84	100	23	15	3025	3301
## 254	8277.619	91	100	15	12	1750	1976
## 255	12489.048	100	98	29	14	6225	3970
## 256	9300.000	100	76	10	19	750	1271
## 257	10327.143	100	93	24	20	3595	3468
## 258	7280.476	97	100	10	22	1100	2000
## 259	6002.857	100	89	14	18	2145	2289
## 260	8348.571	100	82	21	14	2965	3136
## 261	6410.000	100	71	25	15	3485	4169
## 262	7426.190	83	100	17	19	2885	2873
## 263	7263.810	73	100	17	23	2635	3113
## 264	6248.095	78	100	17	14	2110	3152
## 265	9717.619	100	90	26	10	3015	3201
## 266	8311.429	100	90	13	16	1110	1852
## 267	10463.333	92	100	19	18	3370	2939
## 268	9180.952	100	66	14	7	3080	1910
## 269	10266.190	100	81	24	10	4290	3680
## 270	7868.095	100	83	13	17	2500	2643
## 271	9650.952	98	100	27	19	4330	3695
## 272	7186.667	75	100	16	16	1780	2115
## 273	9336.190	100	86	19	12	2545	2659
## 274	8016.190	100	67	15	18	2085	2351
## 275	8940.000	100	77	15	11	2670	1856
## 276	12195.714	75	100	21	15	3665	3236
## 277	10260.476	100	65	20	13	4425	3270

## 278	9366.190	87	100	13	19	2035	1726
## 279	5413.810	100	79	14	16	1460	1789
## 280	8284.762	88	84	14	17	2425	2490
## 281	10802.857	95	100	13	15	2480	2247
## 282	9250.476	85	100	18	21	2830	2529
## 283	10599.524	78	90	25	13	5385	3665
## 284	7752.857	84	100	21	9	4470	3165
## 285	12395.238	100	82	25	12	4515	3739
## 286	10417.143	78	70	16	10	3735	3270
## 287	8376.667	92	100	27	16	3520	3321
## 288	9160.476	58	65	21	14	3070	2555
## 289	3714.762	37	65	6	17	570	986
## 290	6850.476	91	100	11	13	2110	1514
## 291	10317.619	100	96	23	13	3765	3308
## 292	7408.571	67	100	14	14	3245	2210
## 293	10214.286	74	100	20	15	4950	3430
## 294	16066.190	85	73	24	6	6645	3841
## 295	6048.571	100	57	17	4	4730	2170
## 296	14257.619	100	86	21	10	4715	3328
## 297	9975.238	80	97	25	15	5860	4098
## 298	6400.476	100	50	9	8	750	1273
## 299	10153.333	98	93	25	12	4220	3754
## 300	5909.524	98	100	12	15	1690	1589
## 301	5088.571	74	100	8	13	1390	1111
## 302	7232.857	71	68	9	11	1165	1130
## 303	5477.143	84	100	13	14	1990	2050
## 304	9699.048	100	84	21	13	4025	2740
## 305	10211.429	100	94	14	15	2380	2269
## 306	7724.762	93	100	21	15	4035	2989
## 307	11904.762	90	74	15	17	1710	2154
## 308	8308.095	100	86	24	17	4515	3442
## 309	15205.714	96	87	30	17	5405	4084
## 310	9324.286	97	100	18	21	2410	3136
## 311	10266.667	100	82	33	12	5140	4245
## 312	8426.190	95	98	24	17	3305	3875
## 313	5340.476	70	100	14	16	1725	1721
## 314	4737.619	100	88	14	16	1620	2359
## 315	11853.810	100	85	22	9	4895	2897
## 316	6273.333	100	74	10	8	1685	1290
## 317	7672.381	82	100	19	18	2595	3081
## 318	13394.286	100	85	26	14	2960	3660
## 319	8259.524	100	86	18	15	2585	3238
## 320	11734.762	100	90	22	22	2860	3093
## 321	8655.714	100	94	14	14	2085	2019
## 322	10773.810	100	81	20	14	3105	2963
## 323	6889.524	89	100	14	18	1875	2264
## 324	5608.095	97	100	10	19	1475	1620
## 325	7359.524	100	68	20	12	3760	2657
## 326	12101.905	68	73	20	17	3825	2830
## 327	7753.333	100	68	19	18	2045	2685
## 328	11219.048	100	81	21	12	4855	3110
## 329	11427.619	100	65	19	10	4850	2676
## 330	10754.762	91	95	20	13	3420	3643
## 331	12240.952	100	93	21	16	3885	3117

## 332	5275.714	79	100	18	20	2105	2142
## 333	7178.571	250	52	12	12	2310	1503
## 334	9733.810	100	94	17	12	2860	2565
## 335	4389.048	81	100	13	17	2030	2189
## 336	7876.190	86	100	13	15	3510	2323
## 337	9280.000	100	85	25	12	3880	3756
## 338	9106.190	100	65	22	11	3735	3454
## 339	7339.048	100	85	13	13	2445	1686
## 340	8526.667	100	76	16	10	3155	2428
## 341	8264.286	98	73	16	14	2430	2634
## 342	10164.762	89	100	15	16	2940	2325
## 343	10396.667	80	99	19	18	4225	2786
## 344	5550.476	85	100	20	15	3770	3200
## 345	10693.333	77	100	10	14	1785	1624
## 346	8314.762	100	56	33	15	4730	4716
## 347	8712.381	100	75	22	13	3080	2864
## 348	9690.000	85	65	16	14	2510	2772
## 349	7311.905	88	97	14	15	1760	1932
## 350	6111.429	67	100	12	17	1580	1592
## 351	7712.381	98	100	19	19	2805	2518
## 352	9390.952	100	97	17	12	2390	2661
## 353	10085.238	100	96	18	14	3130	2388
## 354	9066.667	81	80	17	19	2595	2960
## 355	12853.333	94	74	26	18	3230	4278
## 356	8818.571	89	100	24	21	3130	3052
## 357	15215.714	200	250	42	27	4175	5812
## 358	7329.048	250	97	17	22	2635	2389
## 359	9965.714	187	164	20	29	2855	2607
## 360	10630.476	250	135	19	15	2930	2414
## 361	4990.952	115	250	10	29	1500	1299
## 362	9840.000	250	171	20	23	2305	2604
## 363	12935.714	250	126	30	24	3310	2978
## 364	10160.000	114	250	25	26	2820	3582
## 365	13507.143	250	233	39	27	3585	5141
## 366	10167.619	219	250	21	28	2670	2353
## 367	10133.810	250	135	27	25	3410	3363
## 368	15025.714	215	250	39	31	4545	5201
## 369	11647.143	175	250	36	29	3975	4088
## 370	12954.545	250	224	34	29	3775	4361
## 371	6226.364	250	30	14	10	2435	1713
## 372	9037.273	250	121	21	24	2015	2494
## 373	19560.000	250	160	27	15	4530	3591
## 374	13993.636	232	250	28	25	3715	3738
## 375	13090.909	250	177	32	28	4035	4674
## 376	12941.818	250	184	33	11	5250	4887
## 377	22841.818	250	33	28	4	9734	3795
## 378	10639.091	250	91	27	16	3340	2809
## 379	10644.545	194	250	33	25	4310	4124
## 380	8089.091	250	105	8	14	1095	1585
## 381	6916.364	164	250	14	21	1790	1996
## 382	7860.909	144	250	20	18	1935	2175
## 383	12027.273	250	203	30	28	4215	4256
## 384	11409.091	250	132	26	15	3225	3816
## 385	15704.545	199	250	33	21	4560	4677

## 386	11688.182	250	154	21	22	2860	3574
## 387	8440.000	250	158	19	22	2635	2087
## 388	11179.091	250	218	22	31	2585	2142
## 389	5832.727	250	66	10	18	1480	1829
## 390	16221.818	250	117	31	14	3360	4142
## 391	11575.455	59	250	20	17	2060	2527
## 392	8327.273	136	250	19	25	2394	2497
## 393	7731.818	250	134	15	14	1420	2346
## 394	18454.545	87	240	43	25	4460	5926
## 395	16285.455	201	250	55	24	6535	6801
## 396	13974.545	128	250	23	30	3180	3104
## 397	7925.455	164	250	22	23	3130	3349
## 398	11379.091	250	63	17	15	1680	2513
## 399	15487.273	250	210	40	22	3995	4894
## 400	10080.909	250	148	15	17	2575	1586
## 401	11230.909	250	12	23	11	2415	2914
## 402	10120.952	191	250	20	20	2260	2464
## 403	10766.667	185	250	33	18	4015	3917
## 404	9167.143	192	250	17	23	2200	2032
## 405	7680.476	217	250	13	16	2320	1693
## 406	8653.333	90	100	19	18	4225	2623
## 407	7210.476	86	87	16	14	1925	2781
## 408	7355.714	95	100	12	11	1930	1964
## 409	16875.714	88	100	28	14	5510	3744
## 410	8694.286	100	87	20	17	4040	2733
## 411	5780.000	100	60	14	12	1370	2380
## 412	6238.095	100	71	15	9	2065	2392
## 413	16841.429	250	98	38	26	4800	4360
## 414	13106.190	250	243	38	31	4350	4798
## 415	4695.714	250	1	10	9	1555	1322
## 416	10243.810	250	180	26	22	3365	3620
## 417	5004.286	250	2	11	6	3010	1057
## 418	9872.381	250	186	37	21	3875	4677
## 419	12834.286	250	151	32	22	5040	4488
## 420	11494.286	241	250	29	29	4075	3714
## 421	13163.810	200	176	19	29	3160	3663
## 422	12680.000	200	165	26	18	4610	4040
## 423	9534.286	171	200	22	27	3500	2741
## 424	7832.381	62	65	23	22	2605	3173
## 425	10339.524	54	65	27	16	3500	3674
## 426	7338.571	65	39	10	10	1525	1397
## 427	10300.000	250	77	17	8	2645	2656
## 428	7484.762	99	250	11	20	1335	1696
## 429	8267.619	109	250	16	19	2345	2899
## 430	19292.857	250	203	39	19	5420	5693
## 431	7206.667	250	117	9	14	2145	1082
## 432	10944.286	250	131	26	10	5280	3492
## 433	7189.048	74	250	19	20	2190	3271
## 434	11528.571	225	250	36	28	4055	4517
## 435	12842.381	250	149	32	14	4100	4299
## 436	7014.762	250	134	9	21	1600	1173
## 437	12982.381	248	250	22	28	3345	2924
## 438	12569.048	250	184	24	20	3235	2861
## 439	14000.476	250	186	35	15	5995	4781

## 440	12263.810	250	186	35	28	3785	4050
## 441	9482.857	250	48	22	10	2445	2996
## 442	12203.333	238	250	34	29	3900	4153
## 443	17408.095	242	249	48	27	5870	6805
## 444	9266.190	143	250	20	28	2485	2235
## 445	12366.667	199	250	38	25	3715	4547
## 446	13497.619	228	250	25	22	3675	3109
## 447	12865.238	250	143	28	27	3310	3635
## 448	8941.818	250	123	19	11	3220	3147
## 449	16970.000	250	202	35	32	5625	4831
## 450	11132.727	250	110	17	13	2435	2382
## 451	16116.364	245	207	25	26	2735	2887
## 452	10995.455	250	245	16	24	2520	2596
## 453	7110.000	136	250	23	20	2810	3330
## 454	10562.727	244	195	23	29	2700	2959
## 455	12009.091	250	54	10	9	1900	1196
## 456	10287.143	218	250	31	33	4140	3898
## 457	9438.182	250	49	9	9	1460	1207
## 458	24842.727	211	250	42	26	6885	5602
## 459	8746.190	250	75	25	14	2490	3139
## 460	12461.905	250	189	33	23	3995	5235
## 461	7633.333	250	27	18	9	2845	2535
## 462	9610.952	250	104	25	14	3755	3182
## 463	10076.190	250	183	26	30	2950	3834
## 464	9487.619	250	179	26	30	2185	3464
## 465	11053.333	205	250	34	31	4460	4977
## 466	15245.238	232	250	37	32	4100	5435
## 467	10674.762	157	250	27	29	3440	3987
## 468	12206.667	233	250	40	11	4535	5068
## 469	7087.619	142	250	25	32	2960	3934
## 470	11797.619	250	138	21	22	2675	2900
## 471	6696.667	237	250	28	26	3665	3747
## 472	16391.429	250	138	43	18	6040	5065
## 473	15289.524	223	250	34	26	4490	4366
## 474	13400.476	250	206	34	17	3425	4307
## 475	9477.143	215	250	20	22	1995	2439
## 476	14662.381	228	250	54	26	6400	7232
## 477	7672.727	64	250	13	22	1975	1567
## 478	9718.182	226	250	12	32	1730	1396
## 479	11921.429	204	250	22	29	2125	2980
## 480	10831.429	156	250	29	14	4270	3194
## 481	8963.810	250	76	31	9	4260	4251
## 482	11163.810	250	187	28	29	2700	3464
## 483	9292.857	250	77	18	13	4125	2104
## 484	6424.762	250	42	13	13	2285	1824
## 485	9707.619	250	155	11	19	2890	1959
## 486	7277.619	103	250	16	21	2750	2565
## 487	9967.619	86	250	17	20	2540	2274
## 488	8386.190	219	250	15	25	2320	2387
## 489	11801.429	219	250	45	18	6305	6127
## 490	13306.667	250	218	28	25	2410	3872
## 491	12720.952	250	208	19	27	2350	2534
## 492	10073.333	151	250	20	29	2040	2871
## 493	12494.762	250	124	40	20	4730	4498

## 494	16637.143	250	237	28	32	4450	4318
## 495	10817.143	105	250	35	28	4375	5021
## 496	21576.190	250	229	60	30	8160	8227
## 497	10209.048	111	250	22	22	3290	3505
## 498	11942.381	250	93	30	12	3670	3951
## 499	6960.952	94	250	14	23	1790	2441
## 500	6310.476	250	76	16	16	2030	2384
## 501	8307.143	250	102	20	20	2555	2447
## 502	11416.190	250	216	29	29	3390	3456
## 503	14503.810	250	185	31	20	3810	3082
## 504	7421.429	56	250	21	13	2145	2880
## 505	10850.476	100	69	27	11	5215	729
## 506	8721.905	78	91	21	13	4615	568
## 507	8477.143	100	94	10	12	1455	272
## 508	7372.381	96	100	13	18	1585	405
## 509	7926.190	100	88	15	11	3195	471
## 510	8397.273	100	97	13	19	2005	395
## 511	11167.619	100	94	19	10	4210	516
## 512	12574.762	100	92	22	15	3250	632
## 513	7246.667	100	85	15	14	3420	407
## 514	11023.810	100	54	20	10	5430	549
## 515	8584.286	82	100	17	20	3485	475
## 516	5207.143	85	100	11	18	2590	323
## 517	10141.429	98	98	22	19	4660	573
## 518	10635.455	189	250	22	25	3705	576
## 519	7651.429	202	250	20	25	2560	524
## 520	6282.857	250	11	7	5	1875	182
## 521	9493.333	250	202	15	24	2405	383
## 522	9113.333	224	250	22	30	2520	567
## 523	12170.952	250	165	24	16	3810	673
## 524	10651.905	250	137	28	14	2940	719
## 525	12030.000	100	86	13	16	2205	364
## 526	6146.364	74	89	11	21	1585	319
## 527	13384.545	200	161	19	33	3215	558
## 528	8901.429	181	200	26	34	4160	620
## 529	11632.857	170	200	24	25	3095	672
## 530	11043.333	100	72	24	13	4020	686
## 531	8615.714	100	94	17	12	2915	454
## 532	11873.333	100	98	26	15	6305	736
## 533	7951.905	100	82	10	16	1425	286
## 534	9603.636	133	250	16	21	3270	448
## 535	8075.238	250	131	12	22	2585	290
## 536	9990.000	100	65	22	8	4780	601
## 537	15939.091	100	96	15	13	2350	432
## 538	8550.000	76	100	16	21	2025	427
## 539	8532.857	86	91	22	13	4535	654
## 540	7946.190	100	75	26	13	5550	728
## 541	5433.636	77	100	15	18	2440	410
## 542	8754.545	100	67	28	13	4540	807
## 543	8861.905	100	84	20	14	3895	559
## 544	5287.619	49	100	5	24	500	158
## 545	9208.571	100	99	18	15	3585	506
## 546	7413.333	250	121	17	11	2520	480
## 547	5139.048	250	101	8	13	1505	189

## 548	6868.571	52	250	15	24	2040	383
## 549	5945.238	236	250	9	26	2185	230
## 550	12835.238	89	100	23	12	5035	619
## 551	7820.476	74	100	13	18	2695	337
## 552	6398.571	97	100	24	16	5630	632
## 553	8978.571	95	100	20	16	4045	560
## 554	6061.905	56	62	10	11	2225	279
## 555	4986.667	94	100	13	10	2185	364
## 556	6740.476	100	96	13	16	2735	342
## 557	10425.714	91	91	18	14	3980	491
## 558	7162.381	97	87	12	12	2450	336
## 559	11095.714	100	90	16	14	3275	446
## 560	9646.190	100	87	16	17	3870	446
## 561	5367.619	62	86	7	18	1345	196
## 562	6770.952	83	71	9	16	1165	261
## 563	7190.952	92	100	19	15	3710	501
## 564	4776.667	100	58	13	2	4055	344
## 565	8334.762	84	89	23	15	4295	644
## 566	6446.667	100	91	8	15	1135	231
## 567	9367.619	250	166	23	17	3465	607
## 568	19601.429	184	250	28	26	4210	738
## 569	6348.095	149	250	11	24	1715	307
## 570	7678.095	250	203	14	21	2075	399
## 571	17696.190	250	236	34	17	6205	868
## 572	4559.048	250	56	7	11	1855	186
## 573	4406.190	65	46	5	12	610	138
## 574	4473.333	47	65	5	22	965	157
## 575	7026.667	100	83	12	15	1295	323
## 576	4636.190	89	100	9	16	975	247
## 577	7687.619	84	100	10	20	1260	251
## 578	7237.143	71	100	12	19	975	322
## 579	11994.762	100	58	11	14	1535	252
## 580	5853.333	79	100	12	17	2350	335
## 581	7009.524	100	55	21	8	4085	566
## 582	4952.857	37	100	12	17	2280	325
## 583	5069.048	100	42	19	7	3905	530
## 584	10177.619	100	87	23	16	3510	582
## 585	10211.429	100	71	16	13	2660	432
## 586	8486.667	84	100	16	20	2760	425
## 587	11219.524	100	94	26	10	7195	728
## 588	9138.095	100	79	24	11	4030	666
## 589	6623.810	77	100	14	18	2120	388
## 590	8676.190	100	57	21	11	3810	561
## 591	15187.619	161	250	30	20	5835	792
## 592	6808.571	97	250	19	18	3845	549
## 593	5438.571	250	101	8	16	1875	224
## 594	11948.095	237	250	23	25	4075	617
## 595	6144.762	38	250	9	19	1190	252
## 596	7635.238	250	66	20	17	3140	532
## 597	13034.762	250	208	27	23	4830	757
## 598	13267.273	250	173	26	29	3680	672
## 599	7300.909	250	24	9	8	1570	227
## 600	14852.381	240	234	39	38	5865	1040
## 601	7526.190	39	250	14	19	1610	364

## 602	6742.857	168	250	18	29	1870	197
## 603	11213.636	250	149	19	27	2725	499
## 604	14802.381	197	250	27	21	4110	695
## 605	12423.333	250	209	25	26	4685	653
## 606	10764.286	227	250	22	27	3780	572
## 607	10345.714	250	215	19	26	2225	461
## 608	6933.810	118	250	20	28	2280	473
## 609	8828.571	250	171	12	18	1930	320
## 610	8116.190	250	157	20	24	2725	559
## 611	11790.952	98	96	30	15	6315	802
## 612	9706.667	100	64	15	10	3085	419
## 613	4305.238	100	35	12	3	2550	322
## 614	5906.190	46	100	11	22	2505	339
## 615	7291.429	100	83	13	13	2010	354
## 616	10030.952	200	135	17	21	3635	479
## 617	9677.619	179	200	23	28	4655	604
## 618	10544.286	250	95	20	18	2300	549
## 619	7319.524	250	166	15	31	2985	351
## 620	6666.667	150	250	13	33	2205	377
## 621	10908.095	250	104	17	17	2350	470
## 622	8200.476	250	89	14	14	2680	381
## 623	6340.476	100	86	17	17	3350	488
## 624	10840.476	76	53	13	9	2550	348
## 625	9409.048	86	91	24	17	4995	657
## 626	8440.909	100	91	17	15	2920	420
## 627	15867.273	95	100	21	16	8710	545
## 628	13219.091	250	196	42	17	8705	1124
## 629	7353.333	250	44	13	5	3845	363
## 630	9980.000	89	100	12	21	2030	335
## 631	8653.636	100	91	18	19	2630	488
## 632	8373.636	100	54	21	6	3285	588
## 633	10647.273	100	68	13	11	2820	364
## 634	8109.091	95	99	16	18	2250	424
## 635	5112.727	100	82	6	13	1590	168
## 636	9477.143	182	250	28	26	3550	728
## 637	9280.476	250	185	16	17	3070	425
## 638	9369.048	88	99	16	20	2405	472
## 639	7685.238	100	89	15	6	4500	401
## 640	10231.818	100	60	18	10	2765	528
## 641	8913.636	250	87	20	15	2975	513
## 642	7692.727	90	90	15	18	1740	419
## 643	12650.909	100	52	21	8	3295	587
## 644	8280.000	100	78	18	11	3225	503
## 645	7328.182	69	100	10	23	1900	280
## 646	10052.727	250	88	14	23	1920	390
## 647	7976.364	169	250	27	16	3755	780
## 648	8025.455	133	250	21	24	2100	556
## 649	7815.238	250	140	20	18	3355	518
## 650	13441.818	250	230	16	26	2355	459
## 651	5880.909	250	104	9	22	1865	210
## 652	13377.273	192	250	25	22	3395	639
## 653	11097.273	250	234	21	25	3065	589
## 654	7455.714	250	36	18	11	2945	482
## 655	18954.545	250	128	30	19	4380	826

## 656	7326.364	250	202	20	24	2795	557
## 657	8292.727	250	43	13	15	1535	324
## 658	7504.545	190	250	10	23	2070	281
## 659	7520.909	56	250	17	17	2530	471
## 660	8136.364	114	250	23	22	3320	621
## 661	9916.364	250	73	23	13	3505	614
## 662	10331.818	250	150	29	18	3435	811
## 663	8900.476	250	130	17	21	3805	466
## 664	9730.000	65	58	19	21	3400	505
## 665	8349.048	46	31	15	7	3480	419
## 666	5550.000	41	65	6	17	1105	148
## 667	9547.273	65	45	18	16	2650	504
## 668	9040.909	50	65	18	15	2790	504
## 669	12518.182	100	70	30	15	4395	833
## 670	8859.091	41	65	9	18	2235	252
## 671	5097.273	88	100	10	15	1645	290
## 672	5281.818	68	100	13	17	1995	371
## 673	6796.364	87	100	17	25	2125	470
## 674	6285.455	47	69	14	10	1945	391
## 675	12672.727	100	75	27	18	5710	754
## 676	5744.545	97	100	22	16	4840	596
## 677	7565.714	95	100	19	18	2700	532
## 678	5731.905	97	100	12	18	1890	354
## 679	5424.762	87	84	15	21	2780	446
## 680	10013.810	97	100	25	17	4365	689
## 681	10688.095	100	70	26	14	4450	701
## 682	9961.905	100	76	27	15	6110	733
## 683	7191.429	100	62	18	10	3535	500
## 684	19266.190	100	90	24	22	4795	694
## 685	4677.619	85	100	17	23	2540	390
## 686	5340.909	93	100	18	19	3635	515
## 687	9887.273	100	63	9	17	1615	252
## 688	9845.455	100	91	17	11	3965	418
## 689	12065.455	250	148	16	20	1720	448
## 690	10100.909	250	220	26	32	4380	697
## 691	8722.727	250	162	14	25	1905	325
## 692	8279.091	250	205	15	27	2175	393
## 693	8388.182	88	100	22	14	4350	604
## 694	9122.727	178	200	10	35	2345	287
## 695	6651.818	189	200	12	31	1715	325
## 696	7495.455	200	139	12	25	2005	325
## 697	11755.455	100	92	20	17	3680	544
## 698	6263.636	204	250	14	33	1745	361
## 699	12266.364	100	88	22	13	3120	615
## 700	10956.364	100	82	22	10	4745	599
## 701	7612.381	90	100	18	18	4225	505
## 702	8020.000	63	100	16	17	2540	405
## 703	10772.857	100	89	29	12	7415	811
## 704	10935.238	100	61	21	8	4330	534
## 705	7669.048	100	94	8	14	1450	171
## 706	6087.619	74	100	11	14	2570	308
## 707	8272.381	73	99	12	17	2430	310
## 708	6919.091	99	100	23	15	6085	620
## 709	10440.000	72	100	18	13	3390	492

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## 710 8307.619      98      100      21      18      5060      565
## 711 11500.000     74      100      22      20      4240      600
## 712 7871.818      100     98       18      16      3660      435
## 713 13889.091     74      67       18      10      4490      477
## 714 4285.455      70      100      4       18      450       88
## 715 6349.091      100     90       11      11      1890      303
## 716 7756.364      77      80       11      22      1505      308
## 717 7812.727      89      93       17      16      3375      476
## 718 9930.000      66      100      8       19      1550      224
## 719 6206.364      100     96       16      12      3075      447
## 720 10080.909     100     87       14      17      2370      359
## 721 10610.909     100     72       26      9       5465      728
## 722 6805.455      100     88       12      8       2730      336
## 723 7583.636      82      100      12      18      2280      336
## 724 8997.273      100     69       15      11      2630      404
## 725 8394.545      76      77       11      13      1780      305
## 726 9422.727      100     72       18      8       3895      503

## ReachedLimit
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# Remove predictors with near-zero variance.
nzv <- nearZeroVar(model_data, saveMetrics = TRUE)
model_data <- model_data[, !nzv$nzv]
model_data

##      ScaledXP TeamScore OpponentScore Eliminations Deaths Score Damage
## 1 10001.818      100          97        22     17   4070    634
## 2 8591.818       76          89        20     15   5305    560
## 3 11770.909      100          92        18     11   3335    483
## 4 5477.143        80         100        10     19   2170    280
## 5 5301.429        71         100        11     19   2195    308
## 6 4798.571        85         100         7     18   850     196

```

## 7	7751.818	86	100	10	21	2240	259
## 8	7953.810	100	70	18	14	3505	504
## 9	9458.182	46	65	11	23	1985	304
## 10	8650.909	47	65	23	12	3400	617
## 11	8893.636	100	94	10	11	1460	306
## 12	5950.000	100	90	11	20	1550	332
## 13	8437.273	100	77	17	12	3765	476
## 14	7743.636	100	98	14	12	2910	371
## 15	9471.818	250	210	14	34	2025	392
## 16	7698.182	250	207	13	42	2045	359
## 17	7695.455	250	143	7	17	1550	192
## 18	4943.636	250	54	10	15	1760	224
## 19	10732.727	214	250	19	26	3260	502
## 20	6611.818	100	99	13	12	1915	344
## 21	8217.273	77	98	17	13	3490	461
## 22	4355.455	53	62	5	13	650	140
## 23	12523.636	100	96	15	15	3615	377
## 24	6595.455	89	100	13	16	2630	363
## 25	5961.818	88	100	13	18	2695	359
## 26	8332.727	88	82	17	18	3120	461
## 27	12645.455	100	54	20	12	3650	490
## 28	4384.286	65	100	8	16	1100	203
## 29	6518.095	100	92	12	16	2650	335
## 30	10268.571	100	96	18	9	3350	504
## 31	6585.714	117	200	21	26	3290	593
## 32	8036.190	140	200	16	18	3250	429
## 33	10536.190	200	200	19	20	3550	549
## 34	6162.857	74	100	18	14	5295	493
## 35	7193.333	71	100	20	18	3290	552
## 36	4668.571	71	100	8	15	1450	207
## 37	6563.810	100	94	12	17	1615	383
## 38	6377.619	100	75	22	13	4250	616
## 39	7472.381	70	100	15	17	3350	407
## 40	8358.571	81	100	10	24	1000	292
## 41	8420.476	100	96	16	15	2670	448
## 42	5463.333	97	100	13	12	1970	404
## 43	9542.857	100	92	23	15	4305	668
## 44	4790.952	91	100	8	13	1380	224
## 45	4177.143	78	100	12	12	2665	356
## 46	7040.476	100	93	21	21	3540	635
## 47	6323.333	100	78	13	13	2310	343
## 48	8298.571	100	75	14	15	3215	392
## 49	7490.000	100	84	14	14	2425	378
## 50	9974.286	100	99	19	15	3705	532
## 51	4912.857	97	100	16	9	2770	448
## 52	7591.905	87	100	23	13	5950	592
## 53	6858.571	100	61	10	10	2905	280
## 54	5687.619	100	95	6	17	1330	168
## 55	6064.286	96	100	15	11	3315	416
## 56	16021.429	100	93	24	10	6150	654
## 57	5802.727	83	100	12	19	2110	280
## 58	4600.000	100	76	19	10	2695	532
## 59	10791.429	93	100	27	10	6110	755
## 60	6087.143	59	100	9	19	1505	290

## 61	5689.048	100	70	8	13	1070	224
## 62	6352.857	67	100	13	16	2650	364
## 63	5634.762	79	95	20	8	5405	552
## 64	8369.524	100	74	14	15	2210	392
## 65	10496.364	100	87	14	10	2420	435
## 66	6359.091	100	80	13	8	2910	412
## 67	5217.273	85	100	12	17	1820	313
## 68	6509.091	100	70	12	12	2930	332
## 69	3450.000	79	100	4	16	500	121
## 70	8904.545	100	51	27	8	5110	746
## 71	10021.818	75	100	13	14	2825	415
## 72	7066.364	100	56	19	12	2720	507
## 73	12569.048	100	99	22	11	4725	621
## 74	7816.364	97	100	13	15	1540	388
## 75	7362.727	80	91	15	18	3175	509
## 76	5102.727	52	100	13	21	2005	342
## 77	6419.048	86	100	17	13	4620	475
## 78	7630.952	100	91	18	15	4115	551
## 79	10057.143	100	71	35	12	7235	960
## 80	10565.455	93	72	15	9	2240	411
## 81	6667.273	55	100	18	18	2645	517
## 82	5486.364	85	100	10	21	1675	280
## 83	6759.091	100	94	18	17	2780	504
## 84	8543.636	81	100	18	12	3100	454
## 85	7771.818	66	91	17	15	2735	452
## 86	5834.762	73	100	17	16	2475	492
## 87	15583.333	68	100	18	13	3480	469
## 88	17511.429	100	98	16	12	7200	448
## 89	7421.818	84	74	12	9	3245	336
## 90	8629.048	100	71	12	12	1980	336
## 91	9027.619	100	85	19	15	2685	531
## 92	7009.048	100	90	15	15	1865	396
## 93	6807.619	100	88	19	13	3590	525
## 94	5530.476	100	92	10	30	815	304
## 95	5375.238	78	100	14	12	3125	356
## 96	5176.190	72	100	14	20	2220	419
## 97	7226.190	66	85	12	21	2086	336
## 98	8374.545	100	83	22	14	2885	599
## 99	9919.091	92	84	14	13	3795	365
## 100	10212.727	77	100	12	21	1490	336
## 101	10922.727	100	92	24	15	5195	672
## 102	9060.000	92	100	18	16	4805	481
## 103	7820.909	84	100	12	13	2540	334
## 104	5544.545	58	100	15	12	3120	400
## 105	10677.273	100	86	27	17	6880	757
## 106	6711.818	69	100	21	12	7315	580
## 107	20864.762	100	68	29	14	5120	761
## 108	5933.636	100	93	13	18	2360	355
## 109	6757.273	79	100	15	23	2840	397
## 110	8481.818	65	100	13	18	2870	364
## 111	9421.818	100	94	18	15	2985	491
## 112	5580.000	100	85	14	14	2515	377
## 113	7950.000	83	100	15	11	3595	392
## 114	10472.727	100	63	26	15	5110	735

## 115	12220.000	87	99	18	18	2325	504
## 116	5958.182	76	100	15	19	2500	408
## 117	8350.000	100	90	14	14	3180	392
## 118	10001.818	100	65	16	12	3245	448
## 119	5073.636	85	100	9	15	1775	252
## 120	5305.455	100	72	11	17	1675	302
## 121	8751.818	95	100	15	14	2700	420
## 122	8974.545	81	100	14	18	2370	397
## 123	6548.182	64	100	16	17	2500	437
## 124	8387.273	100	88	27	11	4530	719
## 125	12422.857	100	98	23	24	3675	647
## 126	7597.273	51	100	17	15	3645	494
## 127	8038.571	77	87	18	10	4565	500
## 128	8102.857	100	60	12	12	2460	336
## 129	8271.429	100	78	17	17	2835	476
## 130	9416.190	100	83	27	14	5550	768
## 131	6582.857	90	100	11	25	2610	300
## 132	5957.273	60	99	10	21	1555	278
## 133	10000.000	94	70	19	10	3515	520
## 134	9564.762	100	88	27	15	4840	756
## 135	9508.095	99	99	23	19	3735	602
## 136	8923.333	73	97	13	21	2650	364
## 137	9958.095	100	77	18	10	4320	510
## 138	8544.762	100	55	24	11	5500	630
## 139	11354.545	100	83	22	12	4930	616
## 140	5958.182	100	83	10	17	1560	280
## 141	5290.000	100	93	9	15	1555	264
## 142	12444.545	100	69	21	6	4185	594
## 143	16831.429	75	100	18	15	7280	503
## 144	6248.182	87	100	10	19	2420	280
## 145	7645.455	100	84	17	11	3065	476
## 146	9995.455	250	94	7	18	1240	195
## 147	6545.455	112	250	22	20	2615	618
## 148	11127.273	226	250	39	32	4955	789
## 149	4534.545	100	91	4	16	550	120
## 150	3460.909	83	100	6	15	1205	139
## 151	7905.455	100	82	7	13	900	196
## 152	8873.636	87	100	16	16	3025	470
## 153	13208.182	100	90	19	15	4570	532
## 154	3747.273	63	100	5	15	1125	140
## 155	8289.091	74	100	12	22	1700	336
## 156	7213.636	100	85	18	15	3875	504
## 157	11722.727	100	96	17	17	3575	387
## 158	7586.364	100	90	10	23	1040	323
## 159	9300.000	100	85	25	13	4765	691
## 160	9828.182	100	79	14	15	2825	399
## 161	4828.182	56	100	8	16	1895	200
## 162	8263.636	53	100	10	16	2105	279
## 163	15300.909	100	62	26	12	6895	728
## 164	7109.048	100	66	18	14	3770	502
## 165	12499.091	100	86	21	19	4710	602
## 166	9389.091	99	100	14	14	3290	392
## 167	10552.857	95	96	22	21	3500	603
## 168	6100.476	90	100	13	21	2870	345

## 169	7367.619	100	86	11	17	2440	295
## 170	7498.571	94	100	10	24	1475	280
## 171	6413.810	91	57	8	17	700	224
## 172	9223.636	97	88	8	14	1480	224
## 173	14750.952	100	48	26	11	6480	706
## 174	11596.364	100	85	23	15	3150	599
## 175	11065.238	95	94	27	17	4560	737
## 176	7813.810	100	82	16	15	2945	426
## 177	8034.762	96	91	20	14	3385	560
## 178	9880.476	82	98	19	11	4360	532
## 179	8892.727	91	86	14	16	2490	358
## 180	9536.364	100	96	18	13	3125	457
## 181	8121.818	88	83	12	14	2215	284
## 182	9217.273	74	65	16	19	2630	403
## 183	12559.091	94	88	16	15	2905	458
## 184	7910.000	59	100	10	18	2080	253
## 185	6815.455	100	84	12	18	1160	303
## 186	8470.909	95	100	16	15	3485	424
## 187	14014.545	100	98	20	16	3425	506
## 188	6571.818	100	79	12	14	3195	335
## 189	6511.818	60	100	14	20	3125	363
## 190	11002.727	100	69	25	9	5710	670
## 191	7381.818	100	89	25	13	3880	765
## 192	7077.619	100	70	23	10	3235	3306
## 193	14782.857	100	96	16	16	2480	2611
## 194	7693.810	100	99	25	19	3185	3301
## 195	8035.238	100	77	22	14	4215	3215
## 196	13966.190	100	84	31	18	4415	4587
## 197	7234.762	97	100	17	17	2620	2466
## 198	7966.190	77	100	21	18	2405	3111
## 199	8136.190	100	73	25	14	2695	3319
## 200	7432.857	85	100	17	17	3140	2222
## 201	6398.571	93	100	14	16	1895	1677
## 202	8362.381	75	81	17	17	2930	2471
## 203	11744.762	59	100	17	18	3025	3068
## 204	8039.048	65	100	15	22	2730	2570
## 205	7614.762	98	250	20	20	3000	2597
## 206	6620.476	119	250	17	27	2125	2432
## 207	7938.571	171	250	22	26	2935	3770
## 208	11594.286	250	176	24	26	3355	3343
## 209	11908.571	212	250	29	24	4155	3951
## 210	7489.048	64	250	10	23	1845	1386
## 211	10872.381	250	215	31	34	3675	3301
## 212	6350.952	95	100	10	18	1710	1668
## 213	10974.762	88	85	15	12	2375	2000
## 214	7540.952	100	85	12	15	1300	1842
## 215	13663.810	100	99	28	17	6445	4072
## 216	7648.571	87	100	17	19	2485	2478
## 217	8014.286	100	75	26	13	3725	3028
## 218	9409.524	98	95	22	12	3600	3105
## 219	9650.476	79	100	20	13	2540	2956
## 220	7541.429	85	100	14	12	2775	2071
## 221	6839.524	55	100	16	15	2455	2670
## 222	4053.333	50	100	7	16	1210	1220

## 223	6304.286	81	91	12	20	800	1574
## 224	7982.381	100	63	16	9	1965	2085
## 225	7840.000	63	100	14	15	2180	2213
## 226	9889.048	100	94	23	20	3185	3496
## 227	8000.476	70	100	14	17	1850	1903
## 228	8675.238	100	96	17	12	3330	2183
## 229	9842.381	53	100	15	25	3945	2617
## 230	9466.190	91	100	20	16	3380	2856
## 231	4800.476	89	100	8	15	800	1415
## 232	5303.333	79	100	15	17	2865	2171
## 233	8183.333	61	100	10	23	1420	1425
## 234	8346.190	72	74	14	13	2950	2507
## 235	8125.238	100	60	22	10	3675	2999
## 236	4627.143	86	100	12	11	2370	1805
## 237	8516.667	69	100	14	17	2340	2098
## 238	6134.286	95	74	23	13	4390	3543
## 239	11720.000	100	65	31	13	5455	4304
## 240	8431.429	80	100	12	12	1610	1594
## 241	8666.667	90	100	19	17	3160	3280
## 242	9908.095	100	78	21	12	3980	2925
## 243	9837.619	100	79	17	9	3310	2522
## 244	5798.571	64	100	11	22	1660	1321
## 245	8089.524	100	51	11	10	2040	1452
## 246	10975.238	100	86	23	19	3895	3310
## 247	7728.095	100	90	12	15	1730	1868
## 248	8399.048	85	100	20	15	4395	2971
## 249	14089.048	99	96	24	15	4615	3499
## 250	11733.333	83	70	15	13	2860	2160
## 251	7002.381	100	78	16	16	2780	2260
## 252	8256.190	100	99	15	17	2475	2446
## 253	9794.286	84	100	23	15	3025	3301
## 254	8277.619	91	100	15	12	1750	1976
## 255	12489.048	100	98	29	14	6225	3970
## 256	9300.000	100	76	10	19	750	1271
## 257	10327.143	100	93	24	20	3595	3468
## 258	7280.476	97	100	10	22	1100	2000
## 259	6002.857	100	89	14	18	2145	2289
## 260	8348.571	100	82	21	14	2965	3136
## 261	6410.000	100	71	25	15	3485	4169
## 262	7426.190	83	100	17	19	2885	2873
## 263	7263.810	73	100	17	23	2635	3113
## 264	6248.095	78	100	17	14	2110	3152
## 265	9717.619	100	90	26	10	3015	3201
## 266	8311.429	100	90	13	16	1110	1852
## 267	10463.333	92	100	19	18	3370	2939
## 268	9180.952	100	66	14	7	3080	1910
## 269	10266.190	100	81	24	10	4290	3680
## 270	7868.095	100	83	13	17	2500	2643
## 271	9650.952	98	100	27	19	4330	3695
## 272	7186.667	75	100	16	16	1780	2115
## 273	9336.190	100	86	19	12	2545	2659
## 274	8016.190	100	67	15	18	2085	2351
## 275	8940.000	100	77	15	11	2670	1856
## 276	12195.714	75	100	21	15	3665	3236

## 277	10260.476	100	65	20	13	4425	3270
## 278	9366.190	87	100	13	19	2035	1726
## 279	5413.810	100	79	14	16	1460	1789
## 280	8284.762	88	84	14	17	2425	2490
## 281	10802.857	95	100	13	15	2480	2247
## 282	9250.476	85	100	18	21	2830	2529
## 283	10599.524	78	90	25	13	5385	3665
## 284	7752.857	84	100	21	9	4470	3165
## 285	12395.238	100	82	25	12	4515	3739
## 286	10417.143	78	70	16	10	3735	3270
## 287	8376.667	92	100	27	16	3520	3321
## 288	9160.476	58	65	21	14	3070	2555
## 289	3714.762	37	65	6	17	570	986
## 290	6850.476	91	100	11	13	2110	1514
## 291	10317.619	100	96	23	13	3765	3308
## 292	7408.571	67	100	14	14	3245	2210
## 293	10214.286	74	100	20	15	4950	3430
## 294	16066.190	85	73	24	6	6645	3841
## 295	6048.571	100	57	17	4	4730	2170
## 296	14257.619	100	86	21	10	4715	3328
## 297	9975.238	80	97	25	15	5860	4098
## 298	6400.476	100	50	9	8	750	1273
## 299	10153.333	98	93	25	12	4220	3754
## 300	5909.524	98	100	12	15	1690	1589
## 301	5088.571	74	100	8	13	1390	1111
## 302	7232.857	71	68	9	11	1165	1130
## 303	5477.143	84	100	13	14	1990	2050
## 304	9699.048	100	84	21	13	4025	2740
## 305	10211.429	100	94	14	15	2380	2269
## 306	7724.762	93	100	21	15	4035	2989
## 307	11904.762	90	74	15	17	1710	2154
## 308	8308.095	100	86	24	17	4515	3442
## 309	15205.714	96	87	30	17	5405	4084
## 310	9324.286	97	100	18	21	2410	3136
## 311	10266.667	100	82	33	12	5140	4245
## 312	8426.190	95	98	24	17	3305	3875
## 313	5340.476	70	100	14	16	1725	1721
## 314	4737.619	100	88	14	16	1620	2359
## 315	11853.810	100	85	22	9	4895	2897
## 316	6273.333	100	74	10	8	1685	1290
## 317	7672.381	82	100	19	18	2595	3081
## 318	13394.286	100	85	26	14	2960	3660
## 319	8259.524	100	86	18	15	2585	3238
## 320	11734.762	100	90	22	22	2860	3093
## 321	8655.714	100	94	14	14	2085	2019
## 322	10773.810	100	81	20	14	3105	2963
## 323	6889.524	89	100	14	18	1875	2264
## 324	5608.095	97	100	10	19	1475	1620
## 325	7359.524	100	68	20	12	3760	2657
## 326	12101.905	68	73	20	17	3825	2830
## 327	7753.333	100	68	19	18	2045	2685
## 328	11219.048	100	81	21	12	4855	3110
## 329	11427.619	100	65	19	10	4850	2676
## 330	10754.762	91	95	20	13	3420	3643

## 331	12240.952	100	93	21	16	3885	3117
## 332	5275.714	79	100	18	20	2105	2142
## 333	7178.571	250	52	12	12	2310	1503
## 334	9733.810	100	94	17	12	2860	2565
## 335	4389.048	81	100	13	17	2030	2189
## 336	7876.190	86	100	13	15	3510	2323
## 337	9280.000	100	85	25	12	3880	3756
## 338	9106.190	100	65	22	11	3735	3454
## 339	7339.048	100	85	13	13	2445	1686
## 340	8526.667	100	76	16	10	3155	2428
## 341	8264.286	98	73	16	14	2430	2634
## 342	10164.762	89	100	15	16	2940	2325
## 343	10396.667	80	99	19	18	4225	2786
## 344	5550.476	85	100	20	15	3770	3200
## 345	10693.333	77	100	10	14	1785	1624
## 346	8314.762	100	56	33	15	4730	4716
## 347	8712.381	100	75	22	13	3080	2864
## 348	9690.000	85	65	16	14	2510	2772
## 349	7311.905	88	97	14	15	1760	1932
## 350	6111.429	67	100	12	17	1580	1592
## 351	7712.381	98	100	19	19	2805	2518
## 352	9390.952	100	97	17	12	2390	2661
## 353	10085.238	100	96	18	14	3130	2388
## 354	9066.667	81	80	17	19	2595	2960
## 355	12853.333	94	74	26	18	3230	4278
## 356	8818.571	89	100	24	21	3130	3052
## 357	15215.714	200	250	42	27	4175	5812
## 358	7329.048	250	97	17	22	2635	2389
## 359	9965.714	187	164	20	29	2855	2607
## 360	10630.476	250	135	19	15	2930	2414
## 361	4990.952	115	250	10	29	1500	1299
## 362	9840.000	250	171	20	23	2305	2604
## 363	12935.714	250	126	30	24	3310	2978
## 364	10160.000	114	250	25	26	2820	3582
## 365	13507.143	250	233	39	27	3585	5141
## 366	10167.619	219	250	21	28	2670	2353
## 367	10133.810	250	135	27	25	3410	3363
## 368	15025.714	215	250	39	31	4545	5201
## 369	11647.143	175	250	36	29	3975	4088
## 370	12954.545	250	224	34	29	3775	4361
## 371	6226.364	250	30	14	10	2435	1713
## 372	9037.273	250	121	21	24	2015	2494
## 373	19560.000	250	160	27	15	4530	3591
## 374	13993.636	232	250	28	25	3715	3738
## 375	13090.909	250	177	32	28	4035	4674
## 376	12941.818	250	184	33	11	5250	4887
## 377	22841.818	250	33	28	4	9734	3795
## 378	10639.091	250	91	27	16	3340	2809
## 379	10644.545	194	250	33	25	4310	4124
## 380	8089.091	250	105	8	14	1095	1585
## 381	6916.364	164	250	14	21	1790	1996
## 382	7860.909	144	250	20	18	1935	2175
## 383	12027.273	250	203	30	28	4215	4256
## 384	11409.091	250	132	26	15	3225	3816

## 385	15704.545	199	250	33	21	4560	4677
## 386	11688.182	250	154	21	22	2860	3574
## 387	8440.000	250	158	19	22	2635	2087
## 388	11179.091	250	218	22	31	2585	2142
## 389	5832.727	250	66	10	18	1480	1829
## 390	16221.818	250	117	31	14	3360	4142
## 391	11575.455	59	250	20	17	2060	2527
## 392	8327.273	136	250	19	25	2394	2497
## 393	7731.818	250	134	15	14	1420	2346
## 394	18454.545	87	240	43	25	4460	5926
## 395	16285.455	201	250	55	24	6535	6801
## 396	13974.545	128	250	23	30	3180	3104
## 397	7925.455	164	250	22	23	3130	3349
## 398	11379.091	250	63	17	15	1680	2513
## 399	15487.273	250	210	40	22	3995	4894
## 400	10080.909	250	148	15	17	2575	1586
## 401	11230.909	250	12	23	11	2415	2914
## 402	10120.952	191	250	20	20	2260	2464
## 403	10766.667	185	250	33	18	4015	3917
## 404	9167.143	192	250	17	23	2200	2032
## 405	7680.476	217	250	13	16	2320	1693
## 406	8653.333	90	100	19	18	4225	2623
## 407	7210.476	86	87	16	14	1925	2781
## 408	7355.714	95	100	12	11	1930	1964
## 409	16875.714	88	100	28	14	5510	3744
## 410	8694.286	100	87	20	17	4040	2733
## 411	5780.000	100	60	14	12	1370	2380
## 412	6238.095	100	71	15	9	2065	2392
## 413	16841.429	250	98	38	26	4800	4360
## 414	13106.190	250	243	38	31	4350	4798
## 415	4695.714	250	1	10	9	1555	1322
## 416	10243.810	250	180	26	22	3365	3620
## 417	5004.286	250	2	11	6	3010	1057
## 418	9872.381	250	186	37	21	3875	4677
## 419	12834.286	250	151	32	22	5040	4488
## 420	11494.286	241	250	29	29	4075	3714
## 421	13163.810	200	176	19	29	3160	3663
## 422	12680.000	200	165	26	18	4610	4040
## 423	9534.286	171	200	22	27	3500	2741
## 424	7832.381	62	65	23	22	2605	3173
## 425	10339.524	54	65	27	16	3500	3674
## 426	7338.571	65	39	10	10	1525	1397
## 427	10300.000	250	77	17	8	2645	2656
## 428	7484.762	99	250	11	20	1335	1696
## 429	8267.619	109	250	16	19	2345	2899
## 430	19292.857	250	203	39	19	5420	5693
## 431	7206.667	250	117	9	14	2145	1082
## 432	10944.286	250	131	26	10	5280	3492
## 433	7189.048	74	250	19	20	2190	3271
## 434	11528.571	225	250	36	28	4055	4517
## 435	12842.381	250	149	32	14	4100	4299
## 436	7014.762	250	134	9	21	1600	1173
## 437	12982.381	248	250	22	28	3345	2924
## 438	12569.048	250	184	24	20	3235	2861

## 439	14000.476	250	186	35	15	5995	4781
## 440	12263.810	250	186	35	28	3785	4050
## 441	9482.857	250	48	22	10	2445	2996
## 442	12203.333	238	250	34	29	3900	4153
## 443	17408.095	242	249	48	27	5870	6805
## 444	9266.190	143	250	20	28	2485	2235
## 445	12366.667	199	250	38	25	3715	4547
## 446	13497.619	228	250	25	22	3675	3109
## 447	12865.238	250	143	28	27	3310	3635
## 448	8941.818	250	123	19	11	3220	3147
## 449	16970.000	250	202	35	32	5625	4831
## 450	11132.727	250	110	17	13	2435	2382
## 451	16116.364	245	207	25	26	2735	2887
## 452	10995.455	250	245	16	24	2520	2596
## 453	7110.000	136	250	23	20	2810	3330
## 454	10562.727	244	195	23	29	2700	2959
## 455	12009.091	250	54	10	9	1900	1196
## 456	10287.143	218	250	31	33	4140	3898
## 457	9438.182	250	49	9	9	1460	1207
## 458	24842.727	211	250	42	26	6885	5602
## 459	8746.190	250	75	25	14	2490	3139
## 460	12461.905	250	189	33	23	3995	5235
## 461	7633.333	250	27	18	9	2845	2535
## 462	9610.952	250	104	25	14	3755	3182
## 463	10076.190	250	183	26	30	2950	3834
## 464	9487.619	250	179	26	30	2185	3464
## 465	11053.333	205	250	34	31	4460	4977
## 466	15245.238	232	250	37	32	4100	5435
## 467	10674.762	157	250	27	29	3440	3987
## 468	12206.667	233	250	40	11	4535	5068
## 469	7087.619	142	250	25	32	2960	3934
## 470	11797.619	250	138	21	22	2675	2900
## 471	6696.667	237	250	28	26	3665	3747
## 472	16391.429	250	138	43	18	6040	5065
## 473	15289.524	223	250	34	26	4490	4366
## 474	13400.476	250	206	34	17	3425	4307
## 475	9477.143	215	250	20	22	1995	2439
## 476	14662.381	228	250	54	26	6400	7232
## 477	7672.727	64	250	13	22	1975	1567
## 478	9718.182	226	250	12	32	1730	1396
## 479	11921.429	204	250	22	29	2125	2980
## 480	10831.429	156	250	29	14	4270	3194
## 481	8963.810	250	76	31	9	4260	4251
## 482	11163.810	250	187	28	29	2700	3464
## 483	9292.857	250	77	18	13	4125	2104
## 484	6424.762	250	42	13	13	2285	1824
## 485	9707.619	250	155	11	19	2890	1959
## 486	7277.619	103	250	16	21	2750	2565
## 487	9967.619	86	250	17	20	2540	2274
## 488	8386.190	219	250	15	25	2320	2387
## 489	11801.429	219	250	45	18	6305	6127
## 490	13306.667	250	218	28	25	2410	3872
## 491	12720.952	250	208	19	27	2350	2534
## 492	10073.333	151	250	20	29	2040	2871

## 493	12494.762	250	124	40	20	4730	4498
## 494	16637.143	250	237	28	32	4450	4318
## 495	10817.143	105	250	35	28	4375	5021
## 496	21576.190	250	229	60	30	8160	8227
## 497	10209.048	111	250	22	22	3290	3505
## 498	11942.381	250	93	30	12	3670	3951
## 499	6960.952	94	250	14	23	1790	2441
## 500	6310.476	250	76	16	16	2030	2384
## 501	8307.143	250	102	20	20	2555	2447
## 502	11416.190	250	216	29	29	3390	3456
## 503	14503.810	250	185	31	20	3810	3082
## 504	7421.429	56	250	21	13	2145	2880
## 505	10850.476	100	69	27	11	5215	729
## 506	8721.905	78	91	21	13	4615	568
## 507	8477.143	100	94	10	12	1455	272
## 508	7372.381	96	100	13	18	1585	405
## 509	7926.190	100	88	15	11	3195	471
## 510	8397.273	100	97	13	19	2005	395
## 511	11167.619	100	94	19	10	4210	516
## 512	12574.762	100	92	22	15	3250	632
## 513	7246.667	100	85	15	14	3420	407
## 514	11023.810	100	54	20	10	5430	549
## 515	8584.286	82	100	17	20	3485	475
## 516	5207.143	85	100	11	18	2590	323
## 517	10141.429	98	98	22	19	4660	573
## 518	10635.455	189	250	22	25	3705	576
## 519	7651.429	202	250	20	25	2560	524
## 520	6282.857	250	11	7	5	1875	182
## 521	9493.333	250	202	15	24	2405	383
## 522	9113.333	224	250	22	30	2520	567
## 523	12170.952	250	165	24	16	3810	673
## 524	10651.905	250	137	28	14	2940	719
## 525	12030.000	100	86	13	16	2205	364
## 526	6146.364	74	89	11	21	1585	319
## 527	13384.545	200	161	19	33	3215	558
## 528	8901.429	181	200	26	34	4160	620
## 529	11632.857	170	200	24	25	3095	672
## 530	11043.333	100	72	24	13	4020	686
## 531	8615.714	100	94	17	12	2915	454
## 532	11873.333	100	98	26	15	6305	736
## 533	7951.905	100	82	10	16	1425	286
## 534	9603.636	133	250	16	21	3270	448
## 535	8075.238	250	131	12	22	2585	290
## 536	9990.000	100	65	22	8	4780	601
## 537	15939.091	100	96	15	13	2350	432
## 538	8550.000	76	100	16	21	2025	427
## 539	8532.857	86	91	22	13	4535	654
## 540	7946.190	100	75	26	13	5550	728
## 541	5433.636	77	100	15	18	2440	410
## 542	8754.545	100	67	28	13	4540	807
## 543	8861.905	100	84	20	14	3895	559
## 544	5287.619	49	100	5	24	500	158
## 545	9208.571	100	99	18	15	3585	506
## 546	7413.333	250	121	17	11	2520	480

## 547	5139.048	250	101	8	13	1505	189
## 548	6868.571	52	250	15	24	2040	383
## 549	5945.238	236	250	9	26	2185	230
## 550	12835.238	89	100	23	12	5035	619
## 551	7820.476	74	100	13	18	2695	337
## 552	6398.571	97	100	24	16	5630	632
## 553	8978.571	95	100	20	16	4045	560
## 554	6061.905	56	62	10	11	2225	279
## 555	4986.667	94	100	13	10	2185	364
## 556	6740.476	100	96	13	16	2735	342
## 557	10425.714	91	91	18	14	3980	491
## 558	7162.381	97	87	12	12	2450	336
## 559	11095.714	100	90	16	14	3275	446
## 560	9646.190	100	87	16	17	3870	446
## 561	5367.619	62	86	7	18	1345	196
## 562	6770.952	83	71	9	16	1165	261
## 563	7190.952	92	100	19	15	3710	501
## 564	4776.667	100	58	13	2	4055	344
## 565	8334.762	84	89	23	15	4295	644
## 566	6446.667	100	91	8	15	1135	231
## 567	9367.619	250	166	23	17	3465	607
## 568	19601.429	184	250	28	26	4210	738
## 569	6348.095	149	250	11	24	1715	307
## 570	7678.095	250	203	14	21	2075	399
## 571	17696.190	250	236	34	17	6205	868
## 572	4559.048	250	56	7	11	1855	186
## 573	4406.190	65	46	5	12	610	138
## 574	4473.333	47	65	5	22	965	157
## 575	7026.667	100	83	12	15	1295	323
## 576	4636.190	89	100	9	16	975	247
## 577	7687.619	84	100	10	20	1260	251
## 578	7237.143	71	100	12	19	975	322
## 579	11994.762	100	58	11	14	1535	252
## 580	5853.333	79	100	12	17	2350	335
## 581	7009.524	100	55	21	8	4085	566
## 582	4952.857	37	100	12	17	2280	325
## 583	5069.048	100	42	19	7	3905	530
## 584	10177.619	100	87	23	16	3510	582
## 585	10211.429	100	71	16	13	2660	432
## 586	8486.667	84	100	16	20	2760	425
## 587	11219.524	100	94	26	10	7195	728
## 588	9138.095	100	79	24	11	4030	666
## 589	6623.810	77	100	14	18	2120	388
## 590	8676.190	100	57	21	11	3810	561
## 591	15187.619	161	250	30	20	5835	792
## 592	6808.571	97	250	19	18	3845	549
## 593	5438.571	250	101	8	16	1875	224
## 594	11948.095	237	250	23	25	4075	617
## 595	6144.762	38	250	9	19	1190	252
## 596	7635.238	250	66	20	17	3140	532
## 597	13034.762	250	208	27	23	4830	757
## 598	13267.273	250	173	26	29	3680	672
## 599	7300.909	250	24	9	8	1570	227
## 600	14852.381	240	234	39	38	5865	1040

## 601	7526.190	39	250	14	19	1610	364
## 602	6742.857	168	250	18	29	1870	197
## 603	11213.636	250	149	19	27	2725	499
## 604	14802.381	197	250	27	21	4110	695
## 605	12423.333	250	209	25	26	4685	653
## 606	10764.286	227	250	22	27	3780	572
## 607	10345.714	250	215	19	26	2225	461
## 608	6933.810	118	250	20	28	2280	473
## 609	8828.571	250	171	12	18	1930	320
## 610	8116.190	250	157	20	24	2725	559
## 611	11790.952	98	96	30	15	6315	802
## 612	9706.667	100	64	15	10	3085	419
## 613	4305.238	100	35	12	3	2550	322
## 614	5906.190	46	100	11	22	2505	339
## 615	7291.429	100	83	13	13	2010	354
## 616	10030.952	200	135	17	21	3635	479
## 617	9677.619	179	200	23	28	4655	604
## 618	10544.286	250	95	20	18	2300	549
## 619	7319.524	250	166	15	31	2985	351
## 620	6666.667	150	250	13	33	2205	377
## 621	10908.095	250	104	17	17	2350	470
## 622	8200.476	250	89	14	14	2680	381
## 623	6340.476	100	86	17	17	3350	488
## 624	10840.476	76	53	13	9	2550	348
## 625	9409.048	86	91	24	17	4995	657
## 626	8440.909	100	91	17	15	2920	420
## 627	15867.273	95	100	21	16	8710	545
## 628	13219.091	250	196	42	17	8705	1124
## 629	7353.333	250	44	13	5	3845	363
## 630	9980.000	89	100	12	21	2030	335
## 631	8653.636	100	91	18	19	2630	488
## 632	8373.636	100	54	21	6	3285	588
## 633	10647.273	100	68	13	11	2820	364
## 634	8109.091	95	99	16	18	2250	424
## 635	5112.727	100	82	6	13	1590	168
## 636	9477.143	182	250	28	26	3550	728
## 637	9280.476	250	185	16	17	3070	425
## 638	9369.048	88	99	16	20	2405	472
## 639	7685.238	100	89	15	6	4500	401
## 640	10231.818	100	60	18	10	2765	528
## 641	8913.636	250	87	20	15	2975	513
## 642	7692.727	90	90	15	18	1740	419
## 643	12650.909	100	52	21	8	3295	587
## 644	8280.000	100	78	18	11	3225	503
## 645	7328.182	69	100	10	23	1900	280
## 646	10052.727	250	88	14	23	1920	390
## 647	7976.364	169	250	27	16	3755	780
## 648	8025.455	133	250	21	24	2100	556
## 649	7815.238	250	140	20	18	3355	518
## 650	13441.818	250	230	16	26	2355	459
## 651	5880.909	250	104	9	22	1865	210
## 652	13377.273	192	250	25	22	3395	639
## 653	11097.273	250	234	21	25	3065	589
## 654	7455.714	250	36	18	11	2945	482

## 655	18954.545	250	128	30	19	4380	826
## 656	7326.364	250	202	20	24	2795	557
## 657	8292.727	250	43	13	15	1535	324
## 658	7504.545	190	250	10	23	2070	281
## 659	7520.909	56	250	17	17	2530	471
## 660	8136.364	114	250	23	22	3320	621
## 661	9916.364	250	73	23	13	3505	614
## 662	10331.818	250	150	29	18	3435	811
## 663	8900.476	250	130	17	21	3805	466
## 664	9730.000	65	58	19	21	3400	505
## 665	8349.048	46	31	15	7	3480	419
## 666	5550.000	41	65	6	17	1105	148
## 667	9547.273	65	45	18	16	2650	504
## 668	9040.909	50	65	18	15	2790	504
## 669	12518.182	100	70	30	15	4395	833
## 670	8859.091	41	65	9	18	2235	252
## 671	5097.273	88	100	10	15	1645	290
## 672	5281.818	68	100	13	17	1995	371
## 673	6796.364	87	100	17	25	2125	470
## 674	6285.455	47	69	14	10	1945	391
## 675	12672.727	100	75	27	18	5710	754
## 676	5744.545	97	100	22	16	4840	596
## 677	7565.714	95	100	19	18	2700	532
## 678	5731.905	97	100	12	18	1890	354
## 679	5424.762	87	84	15	21	2780	446
## 680	10013.810	97	100	25	17	4365	689
## 681	10688.095	100	70	26	14	4450	701
## 682	9961.905	100	76	27	15	6110	733
## 683	7191.429	100	62	18	10	3535	500
## 684	19266.190	100	90	24	22	4795	694
## 685	4677.619	85	100	17	23	2540	390
## 686	5340.909	93	100	18	19	3635	515
## 687	9887.273	100	63	9	17	1615	252
## 688	9845.455	100	91	17	11	3965	418
## 689	12065.455	250	148	16	20	1720	448
## 690	10100.909	250	220	26	32	4380	697
## 691	8722.727	250	162	14	25	1905	325
## 692	8279.091	250	205	15	27	2175	393
## 693	8388.182	88	100	22	14	4350	604
## 694	9122.727	178	200	10	35	2345	287
## 695	6651.818	189	200	12	31	1715	325
## 696	7495.455	200	139	12	25	2005	325
## 697	11755.455	100	92	20	17	3680	544
## 698	6263.636	204	250	14	33	1745	361
## 699	12266.364	100	88	22	13	3120	615
## 700	10956.364	100	82	22	10	4745	599
## 701	7612.381	90	100	18	18	4225	505
## 702	8020.000	63	100	16	17	2540	405
## 703	10772.857	100	89	29	12	7415	811
## 704	10935.238	100	61	21	8	4330	534
## 705	7669.048	100	94	8	14	1450	171
## 706	6087.619	74	100	11	14	2570	308
## 707	8272.381	73	99	12	17	2430	310
## 708	6919.091	99	100	23	15	6085	620

## 709	10440.000	72	100	18	13	3390	492
## 710	8307.619	98	100	21	18	5060	565
## 711	11500.000	74	100	22	20	4240	600
## 712	7871.818	100	98	18	16	3660	435
## 713	13889.091	74	67	18	10	4490	477
## 714	4285.455	70	100	4	18	450	88
## 715	6349.091	100	90	11	11	1890	303
## 716	7756.364	77	80	11	22	1505	308
## 717	7812.727	89	93	17	16	3375	476
## 718	9930.000	66	100	8	19	1550	224
## 719	6206.364	100	96	16	12	3075	447
## 720	10080.909	100	87	14	17	2370	359
## 721	10610.909	100	72	26	9	5465	728
## 722	6805.455	100	88	12	8	2730	336
## 723	7583.636	82	100	12	18	2280	336
## 724	8997.273	100	69	15	11	2630	404
## 725	8394.545	76	77	11	13	1780	305
## 726	9422.727	100	72	18	8	3895	503
## ReachedLimit							
## 1		1					
## 2		0					
## 3		1					
## 4		0					
## 5		0					
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# Fit full linear regression model.
full_model <- lm(ScaledXP ~ ., data = model_data)
summary(full_model)

##
## Call:
## lm(formula = ScaledXP ~ ., data = model_data)
##
## Residuals:
##     Min      1Q  Median      3Q     Max 
## -5057.8 -1374.0  -282.5  1050.1  9292.6

```

```

## 
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|) 
## (Intercept) 2.542e+03 3.313e+02 7.673 5.51e-14 ***
## TeamScore   4.300e+00 1.652e+00 2.602 0.00946 ** 
## OpponentScore 1.458e+00 2.094e+00 0.696 0.48659  
## Eliminations 1.060e+02 2.326e+01 4.555 6.16e-06 *** 
## Deaths      4.645e+01 1.940e+01 2.394 0.01692 *  
## Score        7.747e-01 1.009e-01 7.675 5.41e-14 *** 
## Damage       2.176e-01 7.598e-02 2.864 0.00430 ** 
## ReachedLimit 6.463e+02 2.024e+02 3.193 0.00147 ** 
## --- 
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 
## 
## Residual standard error: 2068 on 718 degrees of freedom 
## Multiple R-squared:  0.533, Adjusted R-squared:  0.5284 
## F-statistic: 117.1 on 7 and 718 DF, p-value: < 2.2e-16 
# Perform AIC-based stepwise model selection. 
step_model <- step(full_model, direction = "both", trace = FALSE) 
summary(step_model)

## 
## Call: 
## lm(formula = ScaledXP ~ TeamScore + Eliminations + Deaths + Score + 
##     Damage + ReachedLimit, data = model_data) 
## 
## Residuals: 
##      Min      1Q      Median      3Q      Max 
## -5022.5 -1357.5  -299.6  1067.7  9256.7 
## 
## Coefficients: 
##             Estimate Std. Error t value Pr(>|t|) 
## (Intercept) 2.530e+03 3.307e+02 7.650 6.49e-14 *** 
## TeamScore   4.717e+00 1.539e+00 3.065 0.00226 ** 
## Eliminations 1.090e+02 2.284e+01 4.774 2.19e-06 *** 
## Deaths      5.330e+01 1.672e+01 3.187 0.00150 ** 
## Score        7.699e-01 1.007e-01 7.648 6.55e-14 *** 
## Damage       2.166e-01 7.594e-02 2.852 0.00446 ** 
## ReachedLimit 5.923e+02 1.869e+02 3.169 0.00159 ** 
## --- 
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 
## 
## Residual standard error: 2067 on 719 degrees of freedom 
## Multiple R-squared:  0.5326, Adjusted R-squared:  0.5287 
## F-statistic: 136.6 on 6 and 719 DF, p-value: < 2.2e-16 
# Extract significant predictors (p < 0.01). 
significant_predictors <- summary(step_model)$coefficients 
significant_predictors <- significant_predictors[significant_predictors[,4] < 0.01, ] 
significant_predictors 

##             Estimate Std. Error t value Pr(>|t|) 
## (Intercept) 2529.9524266 330.73060924 7.649587 6.486734e-14 
## TeamScore      4.7173419   1.53921847 3.064764 2.259894e-03

```

```

## Eliminations 109.0127497 22.83665906 4.773586 2.193176e-06
## Deaths         53.2960332 16.72418996 3.186763 1.500985e-03
## Score          0.7698680  0.10065990 7.648209 6.551290e-14
## Damage          0.2166029  0.07593641 2.852425 4.463267e-03
## ReachedLimit   592.2774187 186.89010588 3.169121 1.593791e-03

```

### Task 3

Question : Which classification method best predicts match outcome (win vs. loss) using gameplay statistics and match characteristics?

```

## Create Win/Loss Variable
games_split2 <- games_split %>%
  separate(Result, into = c("TeamScore_raw", "OpponentScore_raw"),
           sep = "-", remove = FALSE) %>%
  mutate(
    TeamScore_raw = as.numeric(TeamScore_raw),
    OpponentScore_raw = as.numeric(OpponentScore_raw),
    Win = ifelse(TeamScore_raw > OpponentScore_raw, 1, 0)
  )

```

#### XGBoost

```

## Warning: Expected 2 pieces. Missing pieces filled with `NA` in 31 rows [221, 232, 240,
## 247, 257, 263, 266, 270, 283, 292, 298, 312, 326, 330, 351, 354, 403, 417, 423,
## 433, ...].
##Build Classification Dataset
class_data <- games_split2 %>%
  select(Win, Eliminations, Deaths, Score, Damage, TeamScore_raw, OpponentScore_raw) %>%
  drop_na()

class_data$Win <- factor(class_data$Win)

##Train/Test Split
set.seed(123)
train_index <- createDataPartition(class_data$Win, p = 0.8, list = FALSE)
train <- class_data[train_index, ]
test <- class_data[-train_index, ]

## ---- Step 4: XGBoost Matrices ----
train_x <- model.matrix(Win ~ . - 1, data = train)
test_x <- model.matrix(Win ~ . - 1, data = test)

train_y <- as.numeric(train$Win) - 1
test_y <- as.numeric(test$Win) - 1

##Fit XGBoost Model ----
xgb_model <- xgboost(
  data = train_x,
  label = train_y,
  nrounds = 100,
  objective = "binary:logistic",
  verbose = 0
)

```

```
## Predictions + Accuracy ----
xgb_pred <- predict(xgb_model, test_x)
xgb_class <- factor(ifelse(xgb_pred > 0.5, 1, 0))

xgb_acc <- mean(xgb_class == test$Win)
xgb_acc

## [1] 0.9751553
```