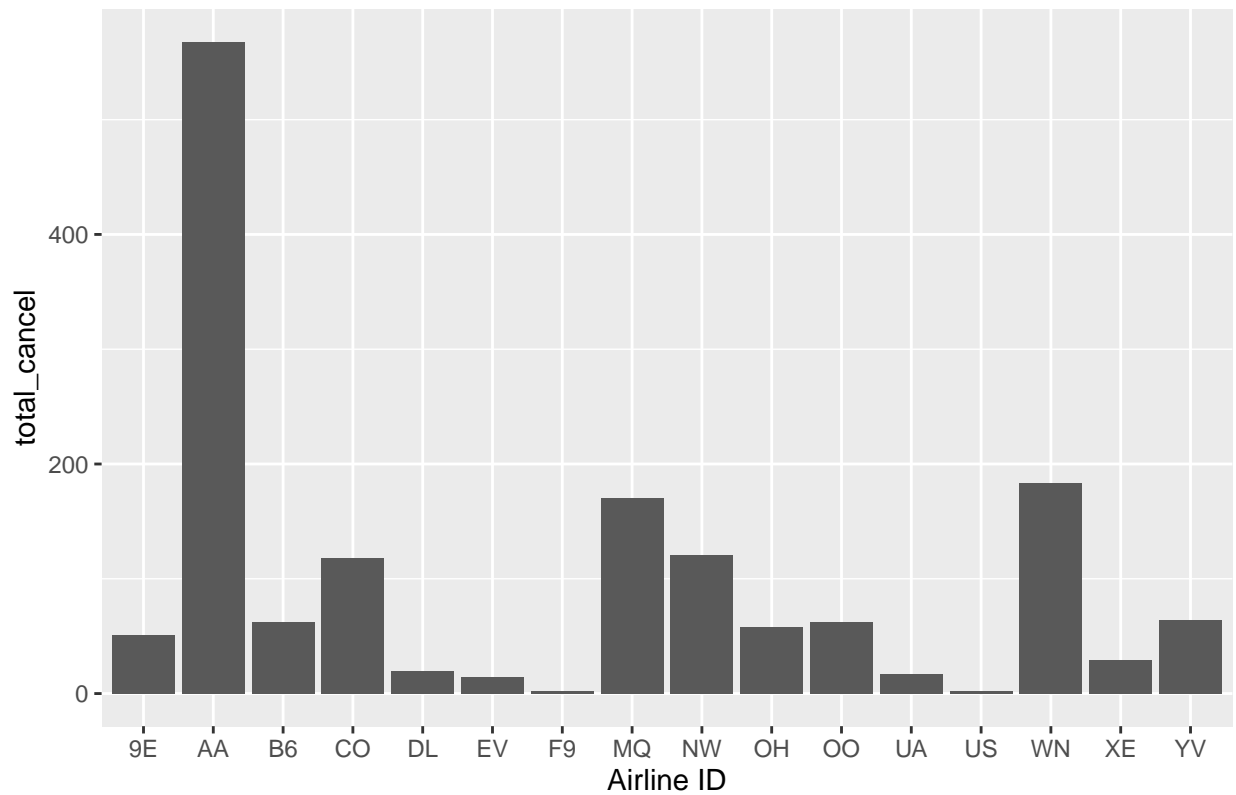# Assignment 1

Elliot Spears

Question 1

For selfish reasons, I simply want to find out which airline has had both the most cancellations and the most delays over the years so that I can avoid flying with them.

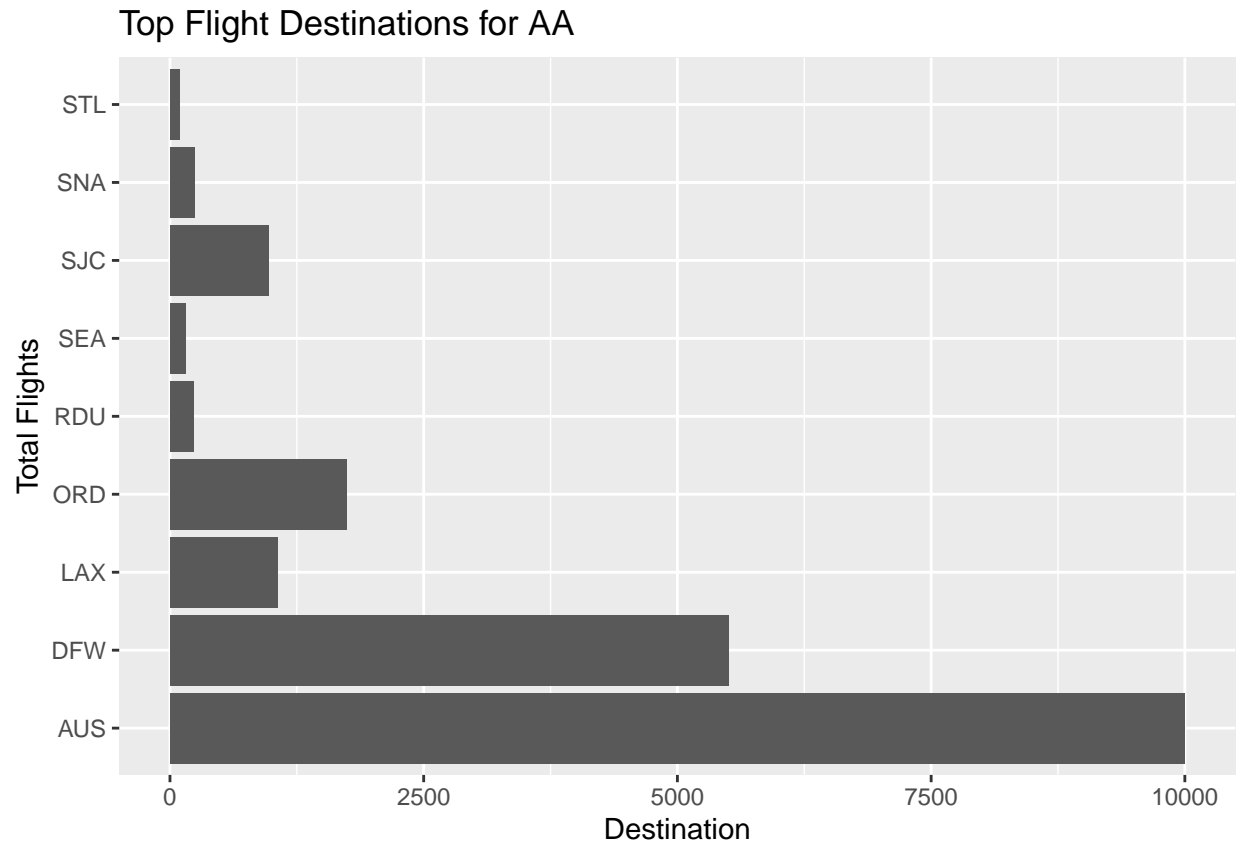### Cumulative Cancelled Flights by Airline

American Airlines has a shockingly large amount of total cancellations compared to other airlines.

Cumulative Cancelled Flights by Destination
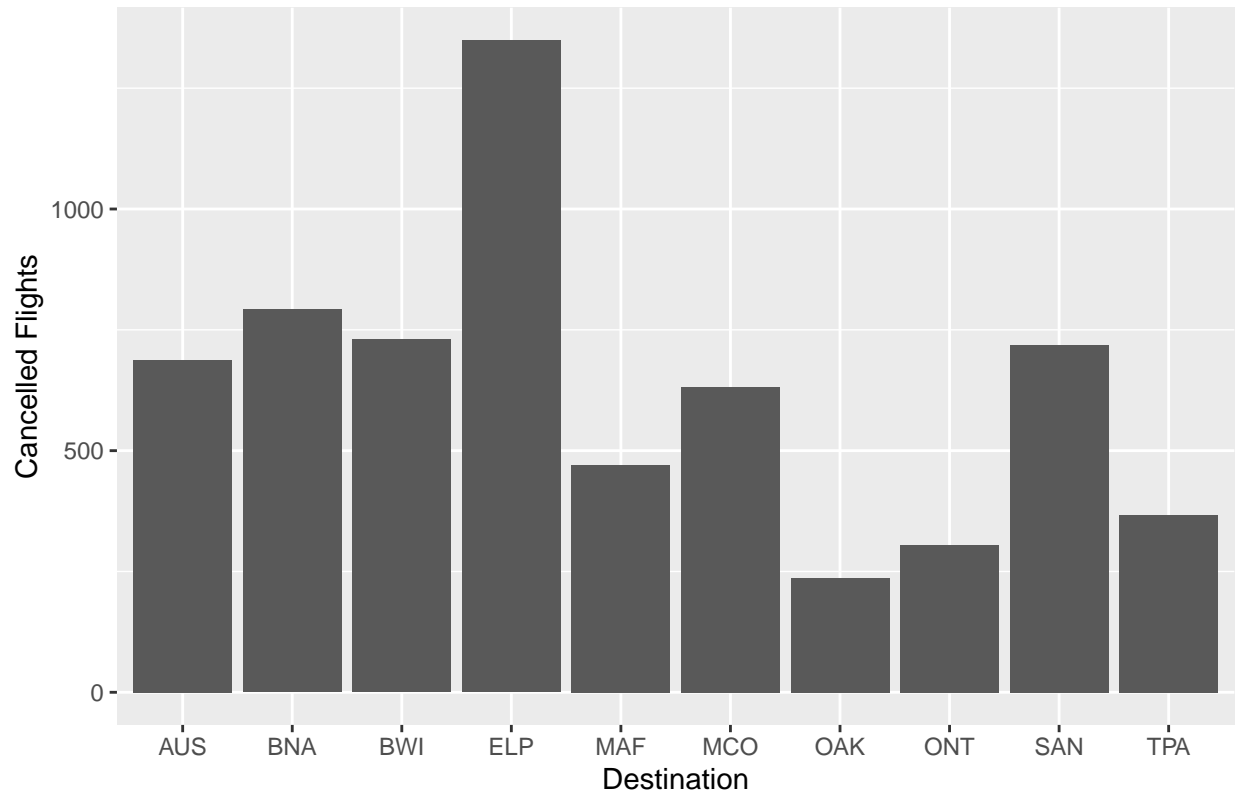
El Paso, TX has the most cancellations, along with San Francisco, CA and Nashville, TN.

Top Flight Destinations for AA

It appears that neither El Paso, nor San Francisco, nor Nashville appear on the most frequent destinations for AA, which would have explained their disproportionately high amount of cancellations.

Cumulative Delay Time by Airline
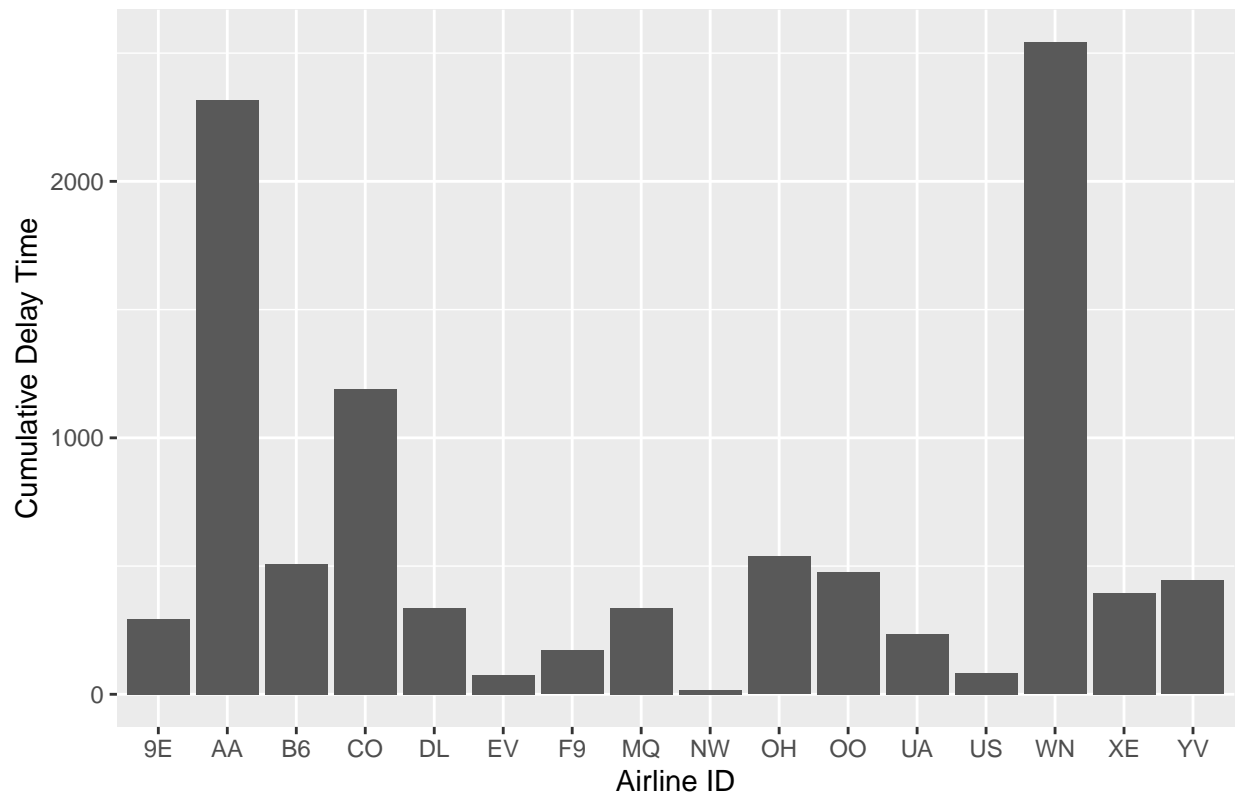
American Airlines has by far the most cancellations of any airline and the second most cumulative carrier delay time. This second place is much larger than the airline that took third place in carrier delay time. This data suggests that I should avoid American Airlines.

I attempted to test whether these issues with AA flights being delayed and cancelled so often can be explained by the destinations AA flies to most often. The plots above show the destinations with the most cancellations, none of which appear on the list of destinations AA flies to most often. Hence, I don't have a good explanation for their shortcomings. All I can conclude with the information I've dug up is that I'll continue to fly United.

Question 2 Part A)

Performer	Song	Count
Imagine Dragons	Radioactive	87
AWOLNATION	Sail	79
Jason Mraz	I'm Yours	76
The Weeknd	Blinding Lights	76
LeAnn Rimes	How Do I Live	69
LMFAO Featuring Lauren Bennett & GoonRock	Party Rock Anthem	68
OneRepublic	Counting Stars	68
Adele	Rolling In The Deep	65
Jewel	Foolish Games/You Were Meant For Me	65
Carrie Underwood	Before He Cheats	64

It looks like our forefathers had a wider breadth of taste in music. Most of these songs were released within

the past 15 years, which indicates that we play the same songs to death more than our predecessors.

Part B

Count of Unique Songs by Year from 1959–2020
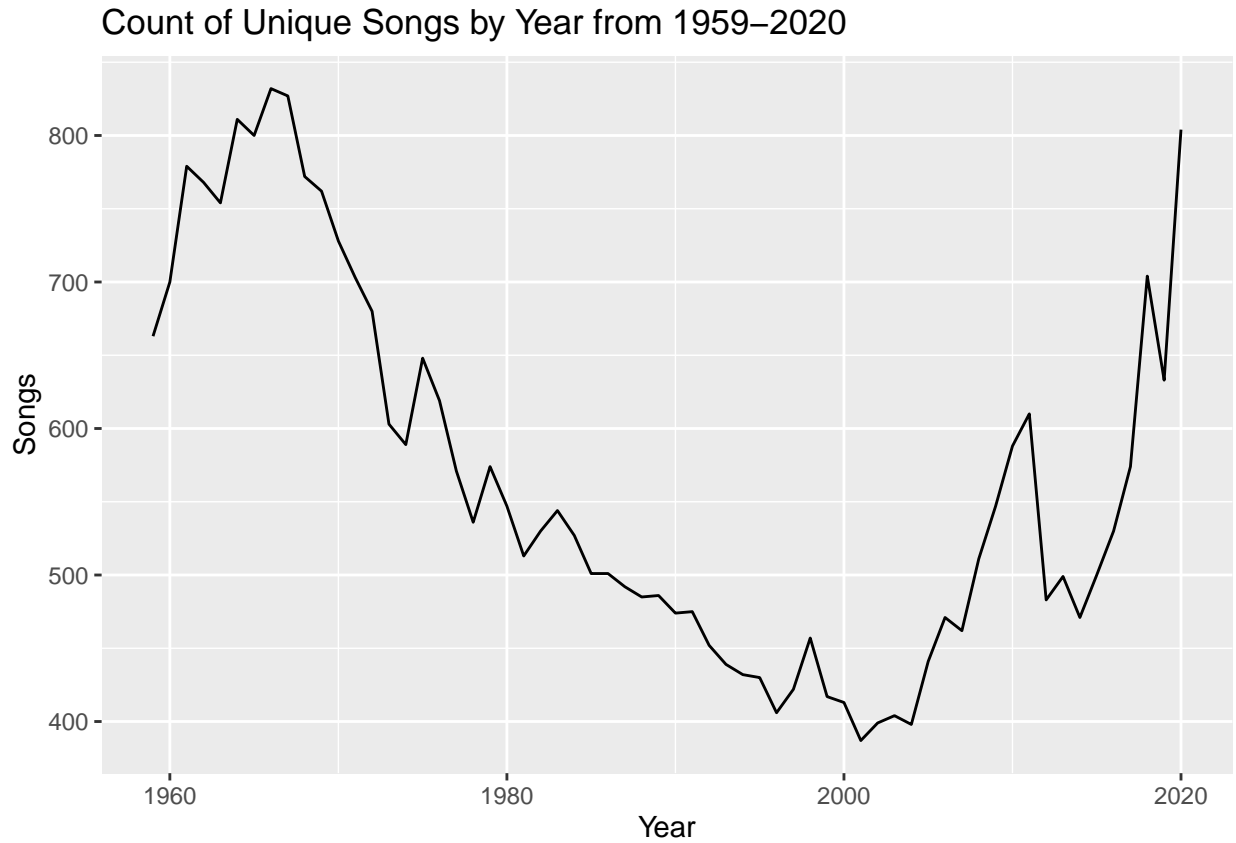
We hit a historical low in the early 2000s in terms of diversity of music that we listened to, which isn't surprising since N-Sync, Backstreet Boys, and Brittany Spears utterly dominated the music industry at that time. Again, it looks like we are getting back on track to enjoying more songs as there has been a large spike in music funneling in and out of the top charts in recent years.

Part C

Artists with over 30 10–week hits or more
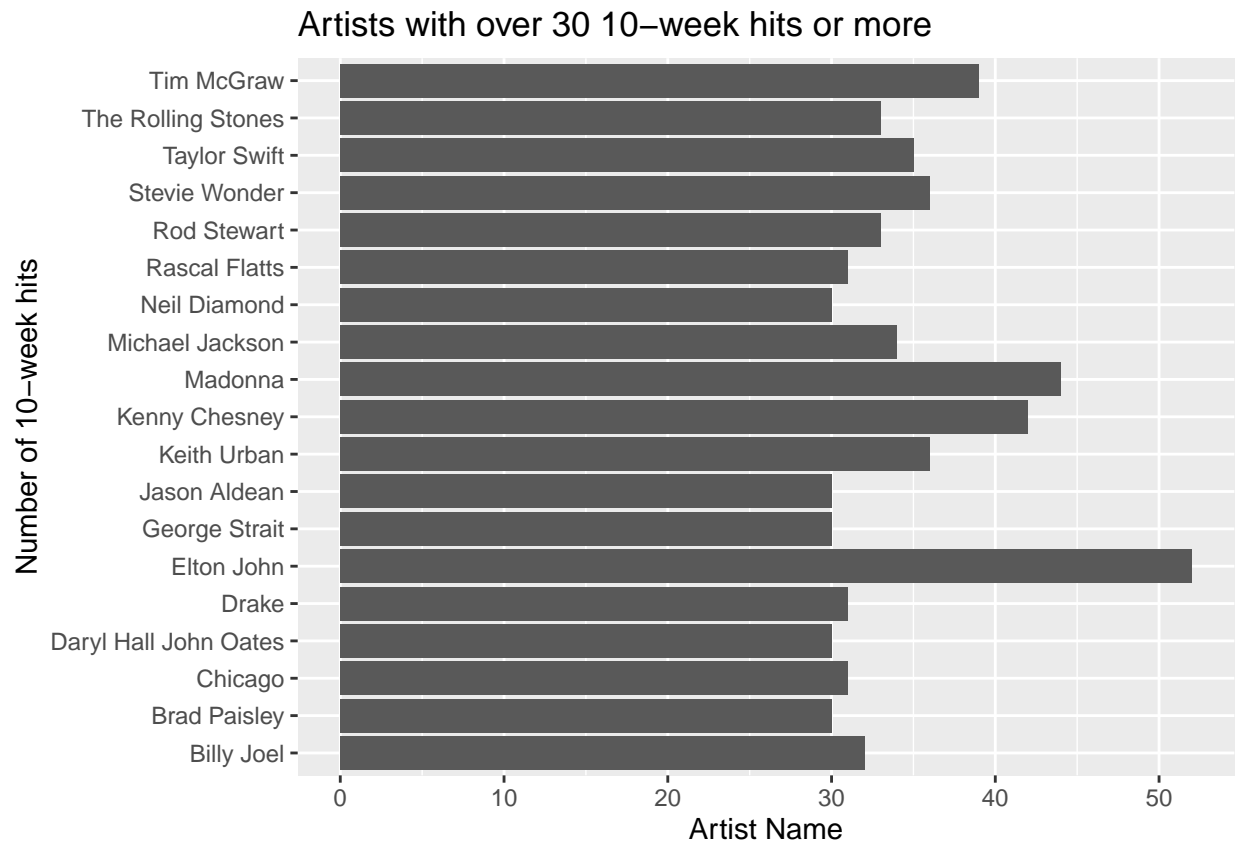
Elton John is the least surprising in terms of who made it onto this list. If you look up his music on spotify or apple music, you will be amazed how many hits that man has created. I'm happy to see several country artists on this chart as it is the superior genre of music in America.

Question 3 Part A

Athletic Event	Height in cm
Athletics Women's Shot Put	191.50
Athletics Women's Heptathlon	188.70
Athletics Women's Discus Throw	188.40
Athletics Women's High Jump	188.00
Athletics Women's Triple Jump	186.90
Athletics Women's Javelin Throw	186.20
Athletics Women's Hammer Throw	183.90
Athletics Women's Pole Vault	183.00
Athletics Women's 400 metres Hurdles	181.40
Athletics Women's Long Jump	181.35
Athletics Women's 200 metres	180.00
Athletics Women's 400 metres	180.00
Athletics Women's 100 metres	179.60
Athletics Women's Pentathlon	179.00
Athletics Women's 4 x 400 metres Relay	178.00

Athletic Event	Height in cm
Athletics Women's 3,000 metres Steeplechase	176.80
Athletics Women's 100 metres Hurdles	176.00
Athletics Women's 4 x 100 metres Relay	176.00
Athletics Women's 800 metres	175.75
Athletics Women's 80 metres Hurdles	174.80
Athletics Women's 20 kilometres Walk	173.00
Athletics Women's 1,500 metres	172.00
Athletics Women's Marathon	171.40
Athletics Women's 5,000 metres	170.75
Athletics Women's 10 kilometres Walk	170.00
Athletics Women's 3,000 metres	170.00
Athletics Women's 10,000 metres	167.80

Clearly the tallest women are those that are in events that require the most physical strength. This isn't surprising as taller people are able to pack more muscle onto their frames than shorter people and, hence, the former are able to become stronger than the latter.

Question 3 Part B

Athletic Event	SD in Height
Rowing Women's Coxed Fours	10.865490
Basketball Women's Basketball	9.700255
Rowing Women's Coxed Quadruple Sculls	9.246396
Rowing Women's Coxed Eights	8.741931
Swimming Women's 100 metres Butterfly	8.134398
Volleyball Women's Volleyball	8.101521
Gymnastics Women's Uneven Bars	8.015942
Shooting Women's Double Trap	7.826238
Cycling Women's Keirin	7.756717
Swimming Women's 400 metres Freestyle	7.624818
Sailing Women's Two Person Dinghy	7.559814
Shooting Women's Air Pistol, 10 metres	7.263169
Swimming Women's 800 metres Freestyle	7.245642
Cross Country Skiing Women's 20 kilometres	7.229569
Shooting Women's Air Rifle, 10 metres	7.219312
Gymnastics Women's Team All-Around	7.124189
Athletics Women's Pole Vault	7.008838
Athletics Women's Triple Jump	6.961143
Gymnastics Women's Balance Beam	6.937343
Sailing Women's Skiff	6.882345
Shooting Women's Small-Bore Rifle, Three Positions, 50 metres	6.875780
Athletics Women's Javelin Throw	6.840463
Gymnastics Women's Floor Exercise	6.821702
Cycling Women's BMX	6.784377
Cycling Women's Individual Time Trial	6.764962
Gymnastics Women's Individual All-Around	6.762194
Athletics Women's High Jump	6.658652
Wrestling Women's Light-Heavyweight, Freestyle	6.658328
Athletics Women's Heptathlon	6.637329

Athletic Event	SD in Height
Gymnastics Women's Horse Vault	6.609611
Shooting Women's Sporting Pistol, 25 metres	6.492819
Swimming Women's 4 x 100 metres Freestyle Relay	6.445143
Athletics Women's 5,000 metres	6.424270
Athletics Women's Discus Throw	6.420398
Athletics Women's Shot Put	6.417684
Fencing Women's epee, Individual	6.408991
Swimming Women's 4 x 200 metres Freestyle Relay	6.393870
Swimming Women's 4 x 100 metres Medley Relay	6.391921
Swimming Women's 200 metres Backstroke	6.334885
Handball Women's Handball	6.323612
Water Polo Women's Water Polo	6.322847
Athletics Women's 100 metres	6.289850
Equestrianism Mixed Dressage, Team	6.184390
Fencing Women's Foil, Team	6.174347
Swimming Women's 200 metres Freestyle	6.172400
Hockey Women's Hockey	6.135671
Athletics Women's 3,000 metres Steeplechase	6.062178
Athletics Women's Long Jump	6.037068
Shooting Women's Trap	5.936168
Football Women's Football	5.929426
Cycling Women's Individual Pursuit, 3,000 metres	5.909637
Fencing Women's Foil, Individual	5.904858
Ice Hockey Women's Ice Hockey	5.892898
Swimming Women's 200 metres Butterfly	5.873842
Athletics Women's Marathon	5.856790
Swimming Women's 100 metres Backstroke	5.846879
Rowing Women's Double Sculls	5.828733
Cross Country Skiing Women's 5 kilometres	5.772009
Equestrianism Mixed Three-Day Event, Team	5.746339
Fencing Women's epee, Team	5.676339
Cross Country Skiing Women's 15 km Skiathlon	5.667892
Cycling Women's Mountainbike, Cross-Country	5.641814
Equestrianism Mixed Jumping, Individual	5.630275
Cross Country Skiing Women's 10 kilometres	5.629182
Swimming Women's 400 metres Individual Medley	5.627469
Swimming Women's 50 metres Freestyle	5.604463
Cross Country Skiing Women's 30 kilometres	5.596051
Athletics Women's 4 x 100 metres Relay	5.568302
Athletics Women's Hammer Throw	5.535169
Athletics Women's 3,000 metres	5.479761
Athletics Women's 10,000 metres	5.409697
Sailing Women's Three Person Keelboat	5.374308
Rowing Women's Coxless Fours	5.350588
Cross Country Skiing Women's 4 x 5 kilometres Relay	5.341851
Athletics Women's 20 kilometres Walk	5.280693
Cross Country Skiing Women's 5/10 kilometres Pursuit	5.244044
Swimming Women's 100 metres Breaststroke	5.239431
Athletics Women's 80 metres Hurdles	5.238954
Cycling Women's Points Race	5.160309
Athletics Women's 200 metres	5.136737
Rowing Women's Quadruple Sculls	5.111388

Athletic Event	SD in Height
Athletics Women's 400 metres Hurdles	5.073253
Swimming Women's 200 metres Breaststroke	5.037536
Cycling Women's Team Pursuit	5.035840
Athletics Women's 1,500 metres	5.032908
Athletics Women's 400 metres	5.011253
Swimming Women's 100 metres Freestyle	4.979346
Swimming Women's 200 metres Individual Medley	4.966555
Equestrianism Mixed Dressage, Individual	4.965489
Athletics Women's Pentathlon	4.945416
Canoeing Women's Kayak Singles, 500 metres	4.901056
Rowing Women's Single Sculls	4.897333
Equestrianism Mixed Three-Day Event, Individual	4.876246
Cross Country Skiing Women's Team Sprint	4.854501
Canoeing Women's Kayak Singles, Slalom	4.717335
Sailing Women's One Person Dinghy	4.710677
Cycling Women's Omnium	4.679744
Athletics Women's 100 metres Hurdles	4.677272
Cycling Women's Sprint	4.633683
Equestrianism Mixed Jumping, Team	4.624984
Cycling Women's Road Race, Individual	4.551697
Athletics Women's 4 x 400 metres Relay	4.521846
Rowing Women's Lightweight Double Sculls	4.504671
Cross Country Skiing Women's Sprint	4.498148
Fencing Women's Sabre, Team	4.494617
Athletics Women's 800 metres	4.481416
Rowing Women's Coxless Pairs	4.384891
Athletics Women's 10 kilometres Walk	4.308905
Cross Country Skiing Women's 3 x 5 kilometres Relay	4.292481
Wrestling Women's Heavyweight, Freestyle	4.250490
Canoeing Women's Kayak Doubles, 500 metres	4.250338
Swimming Women's 10 kilometres Open Water	4.242641
Canoeing Women's Kayak Fours, 500 metres	4.188808
Cross Country Skiing Women's 15 kilometres	4.063884
Wrestling Women's Middleweight, Freestyle	4.043808
Cross Country Skiing Women's 5/5 kilometres Pursuit	4.000000
Wrestling Women's Lightweight, Freestyle	3.976119
Shooting Women's Skeet	3.972525
Cycling Women's Team Sprint	3.910940
Boxing Women's Lightweight	3.833592
Boxing Women's Flyweight	3.732100
Cycling Women's 500 metres Time Trial	3.559026
Sailing Women's Windsurfer	3.353747
Canoeing Women's Kayak Singles, 200 metres	3.250641
Gymnastics Women's Team Portable Apparatus	3.174417
Wrestling Women's Featherweight, Freestyle	3.162278
Fencing Women's Sabre, Individual	3.099365
Wrestling Women's Flyweight, Freestyle	2.924445
Boxing Women's Middleweight	2.911390
Sailing Mixed Multihull	2.081666
Shooting Mixed Skeet	NA
Shooting Mixed Small-Bore Rifle, Three Positions, 50 metres	NA

Upon browsing through the data, the "Rowing Women's Coaxed Fours" event had the highest standard deviation in history for female heights.

Question 3 Part C

### Changes in Average Ages of Olympic Competitors since 1896
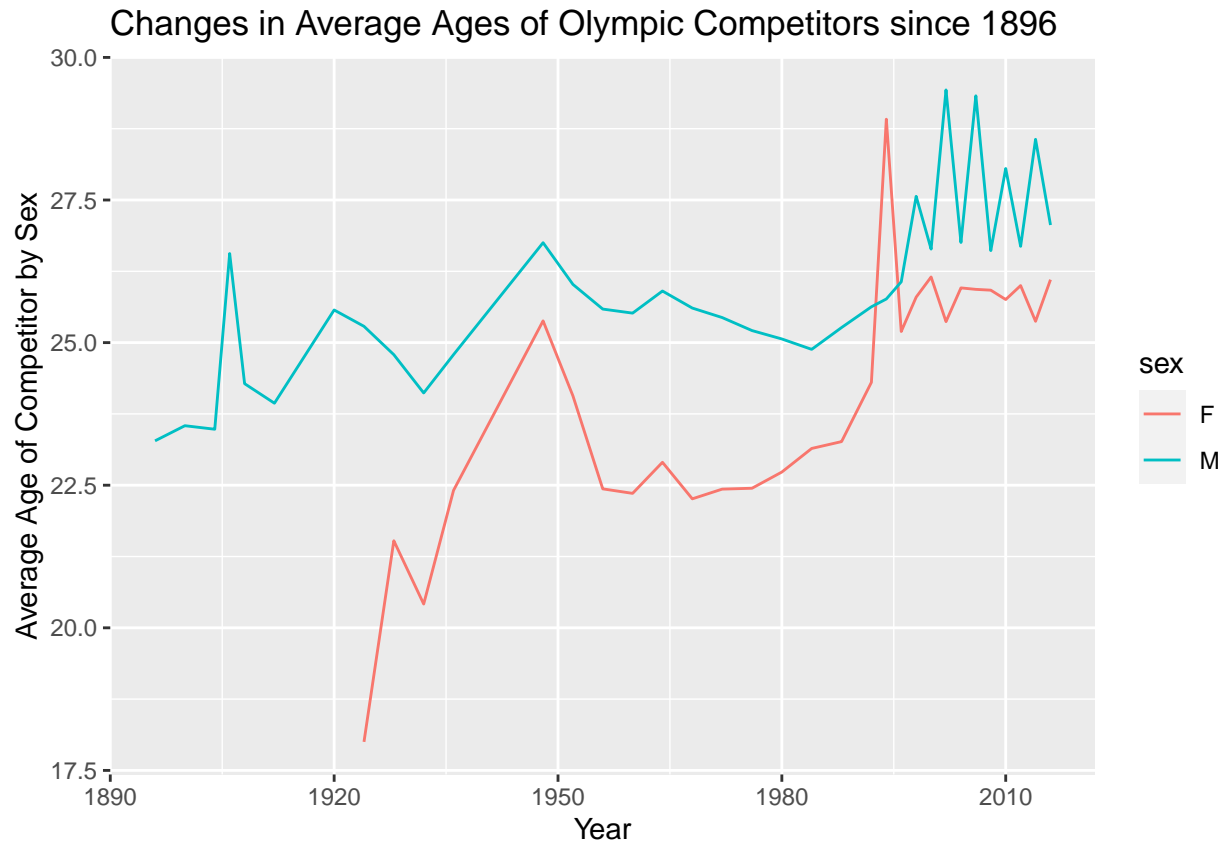
It appears to be the case that there was a greater disparity in ages of competitors as we go further into the past. Women began competing in the olympics in the 20s. From there, men were, on average, consistently older than women all the way up to about the mid 1990s. As we continue from 1896 until today, the gap in average ages seems to have shrunk and the average age range is converging to around 26 years old on average for women and 28 years old for men.
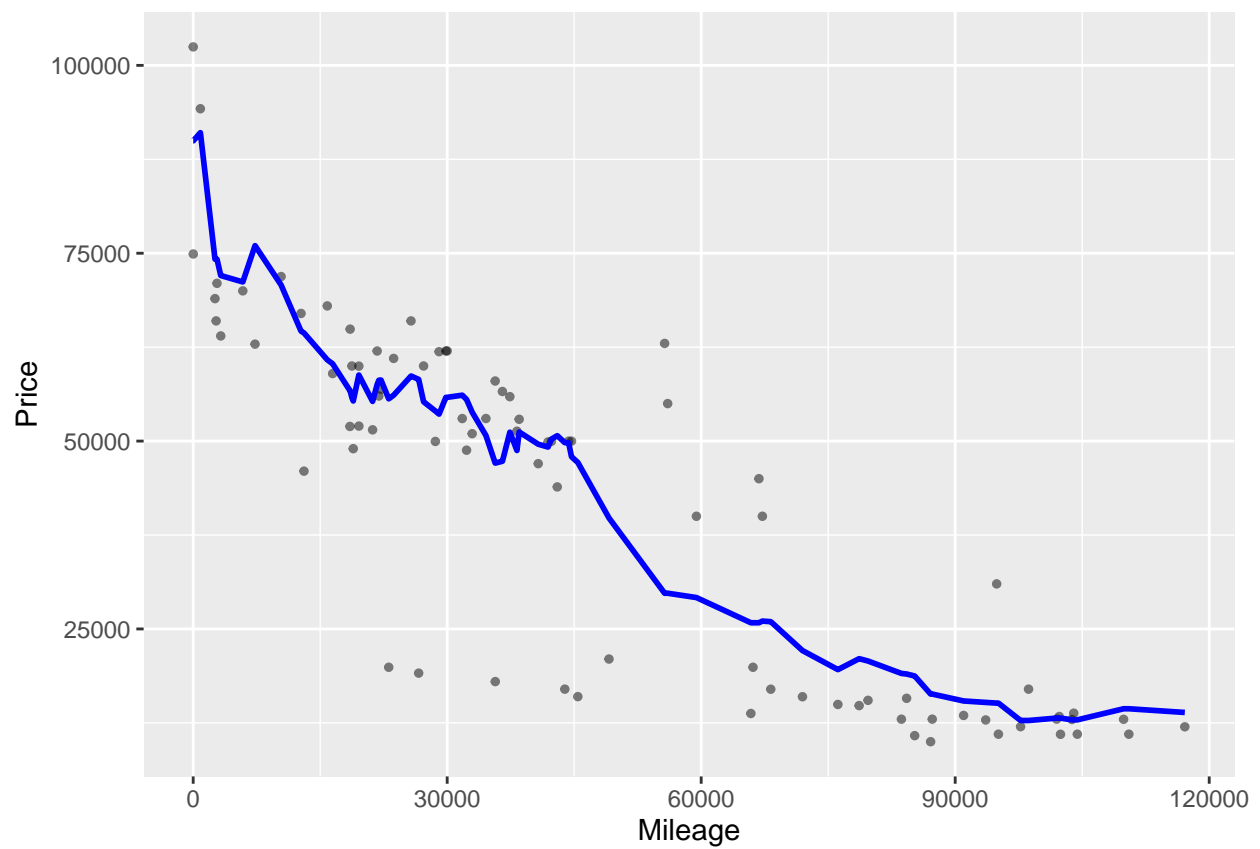
Question 4 Part

```
##  [1] 10618.584 10217.221  8494.603  9963.536 10749.838  9760.819  8935.342
##  [8]  9939.897  8752.473 11617.835
```

```
##  [1] 13010.09 15448.77 14775.31 15850.43 14188.55 14412.56 14934.98 13539.22
##  [9] 14338.81 14091.42
```

S350 Trim RMSE/K plot
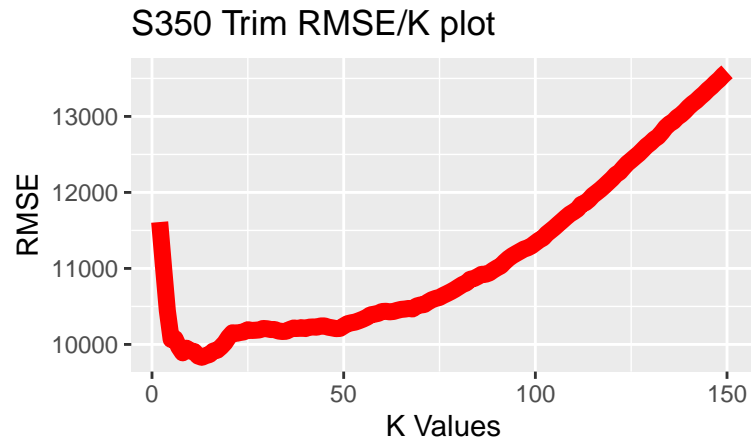
We'll go with K = 13 since the graph bottoms out between 0 and 25. Half of 25 is 12.5, so we'll round up to 13.
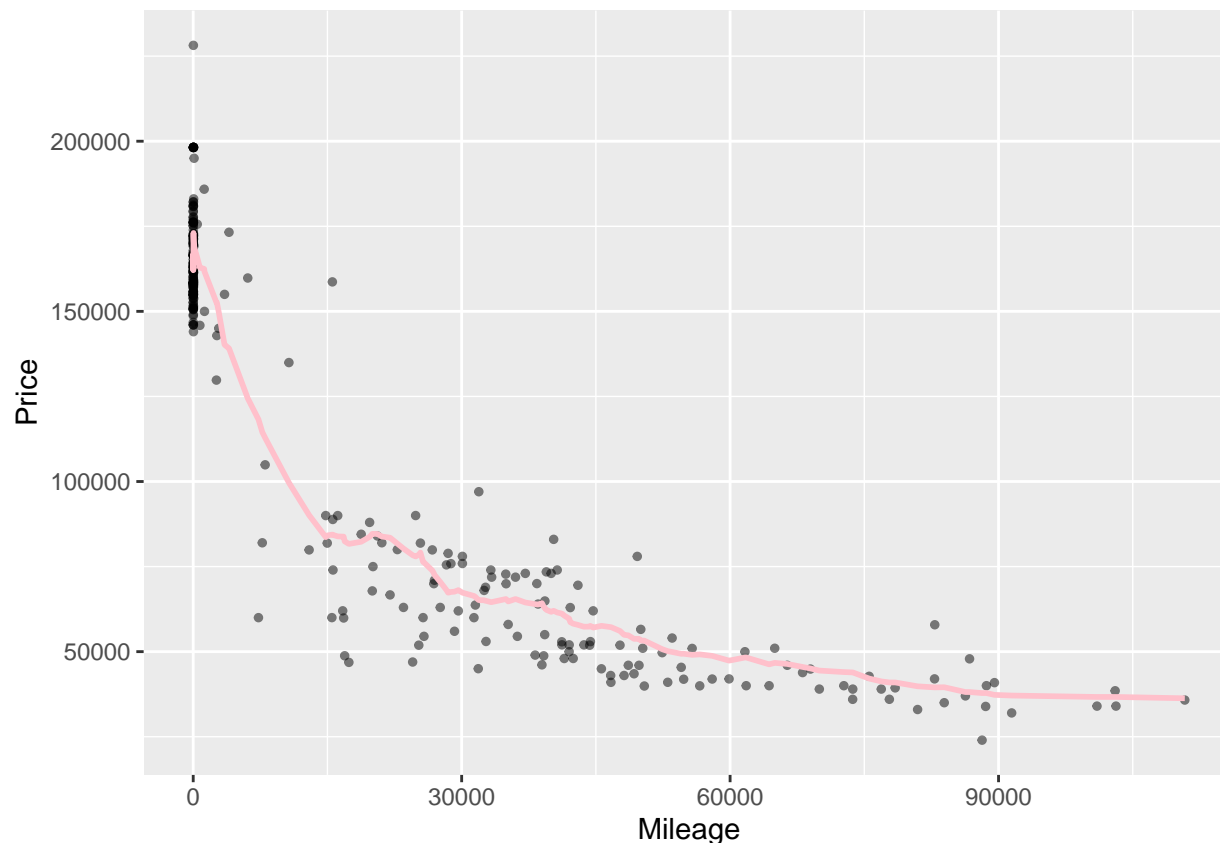

Clearly, the statements about a sharp loss in value the moment you drive off the lot are true as the steepest loss in value comes right after 0. After that point we se a fairly consistent downward trend in price with mileage.
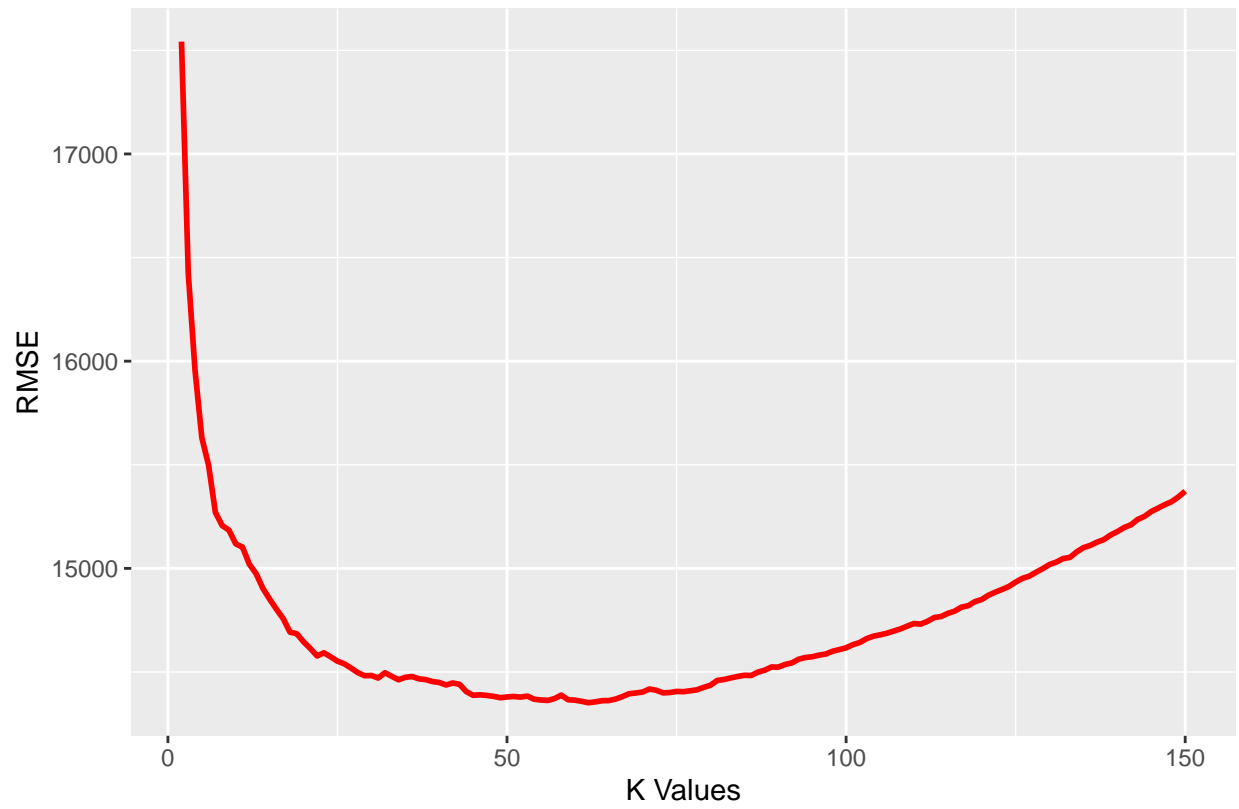
S63 Trim RMSE/K plot

It appears that this plot bottoms out at about K = 51

We see similar behavior in this plot to what we saw in the previous one for the 350: a steep downward trend in price with mileage.

The reason the choices of K are so different for the two trims is simple: the 350 trim is represented by a dataset with far fewer observations than the 63 trim. Some say that a good rule of thumb in making a first pass at estimating the appropriate k value is to take the square root of the observations. Both of those methods were fairly close to the actual K values that we ended up choosing. I conclude that for the 350 and 63 trims, the appropriate K values are 13 and 51, respectively.

tinytex::install_tinytex()