STAT 545 HW 03

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Introduction

In this document, I wll attempt a few tasks. First, I will get the maximum and minimum GDP per capita for each continent and make some comments about them. Second, I will look investigate the spread of GDP per capita within each continent and make further comments. Third, I will compute three different types of means, and asses them relatively to each other. I will also provide plots for easier referencing. Lastly, I will, through the use of visual aids, attempt to explore how life expectancy is changing over time for different continents. So lets begin!!

Load in the required libraries

```
suppressMessages(library("tidyverse"))
library(gapminder)
library(cowplot)
```

```
##
## Attaching package: 'cowplot'
```

```
## The following object is masked from 'package:ggplot2':
##
##     ggsave
```

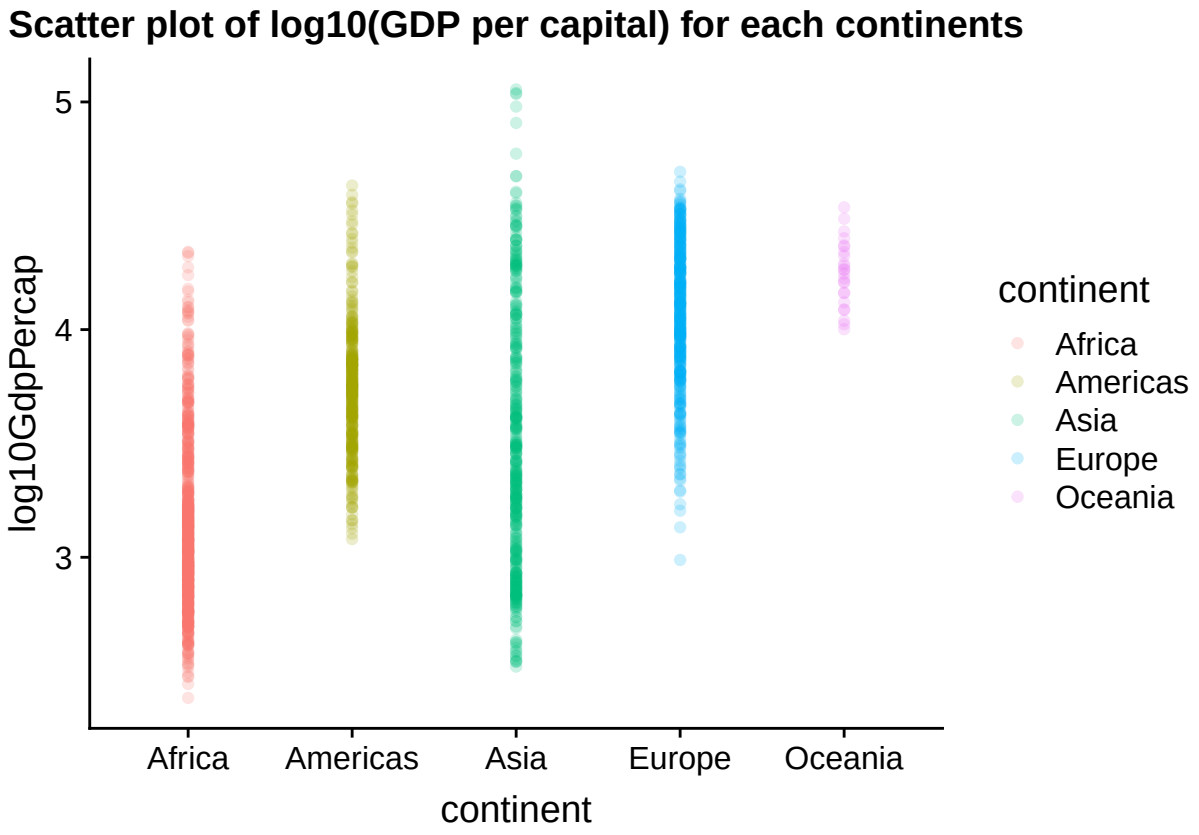
Task 1: Get the maximum and minimum of GDP per capita for all continents.

```
#add log10 gdpPercap
gapminder <- mutate(gapminder, log10GdpPercap =log10(gdpPercap))

#Compute the min and the max GDP per capital for each continent
my.tab <- summarise(group_by(gapminder, continent), min(log10GdpPercap), max(log10GdpPercap))
colnames(my.tab) <- c("Continent", "min", "max")
knitr::kable(my.tab)
```

Continent	min	max
Africa	2.382316	4.341458
Americas	3.079773	4.632980
Asia	2.519828	5.055084
Europe	2.988351	4.693350
Oceania	4.001716	4.537005

We see that Africa has the smallest GDP Per capital amongst all the continents while Oceania has the highest of the minimum GDP per cap for all the continents. We also see that Asia has the highest GDP per cap for all continents and africa has the smallest maximum GDP per cap for all continents.

```
#Show this using some plots
ggplot(gapminder, aes(continent, log10GdpPercap)) +
  geom_point(aes(color = continent),alpha = 0.2) +
  ggtitle("Scatter plot of log10(GDP per capital) for each continents")
```



This plot also reiterates what I concluded above.

Task 2: Look at the spread of GDP per capita within the continents.

To ge the spread of the data, I will use a table first to show the the quartiles, the mean, the mode, the Inter Quartile Range, and the standard deviation of GDP per cap for each continent

```
#create a function to get mode of the data
# Create the function.
mode <- function(data) {
  #compute the unique value in the data
  t1 <- unique(data)
  #compute which is the most occuring unize value
  t1[which.max(tabulate(match(data, t1)))]
}
```

```
sp.table <- summarize(group_by(gapminder, continent), quantile(log10GdpPercap, 0.25), quantile(log10Gdp
colnames(sp.table) <- c("Continent", "1st quartile", "Median", "3rd Quartile", "mean", "Mode", "SD", "I
knitr::kable(sp.table)
```

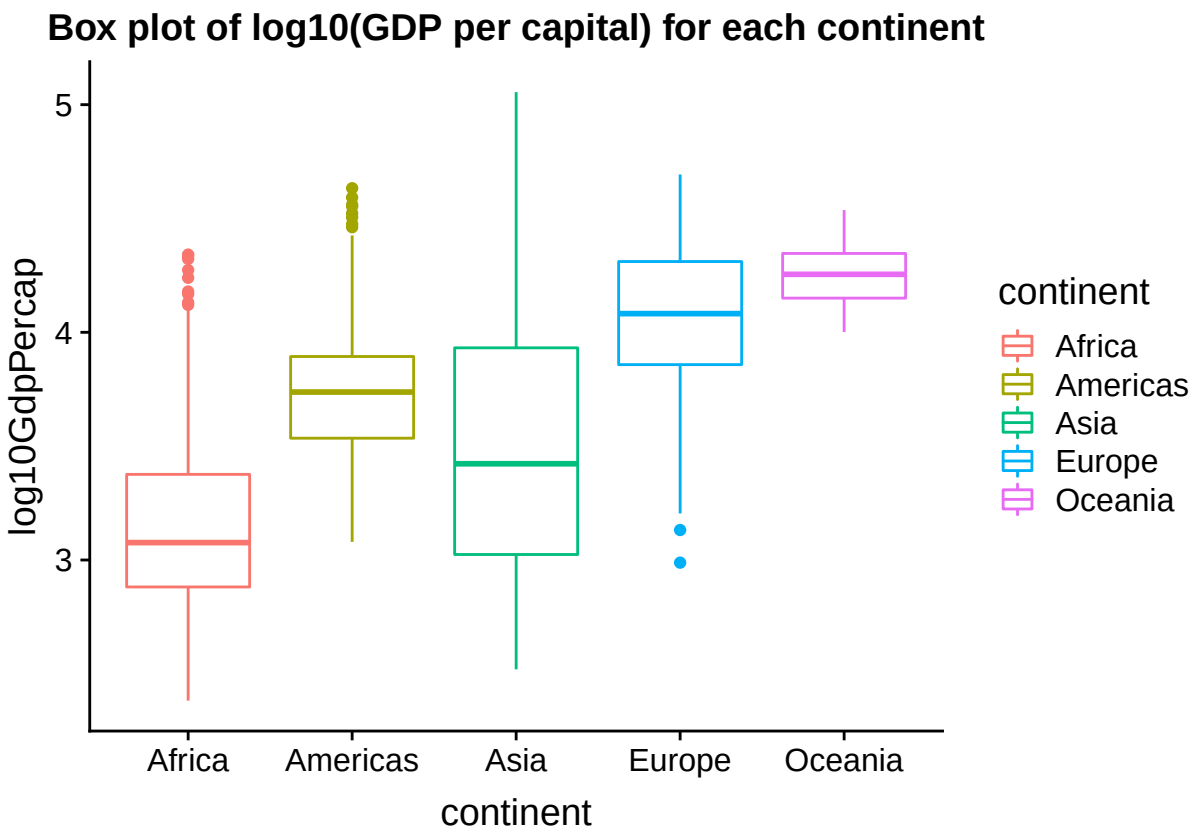
Continent	1st quartile	Median	3rd Quartile	mean	Mode	SD	IQR
Africa	2.881525	3.076326	3.376105	3.147894	3.388990	0.3733077	0.4945803

Continent	1st quartile	Median	3rd Quartile	mean	Mode	SD	IQR
Americas	3.535013	3.737627	3.893768	3.741568	3.771684	0.2965612	0.3587552
Asia	3.024072	3.422719	3.931926	3.505493	2.891786	0.5680604	0.9078538
Europe	3.858114	4.082127	4.310935	4.058228	3.204407	0.3188679	0.4528202
Oceania	4.150158	4.254787	4.346492	4.246647	4.001716	0.1451969	0.1963343

we see that Africa has the smallest variation on GDP per cap amongst all the continents, while Asia has the highest GDP per cap

We can aslo view this graphically using a box plot

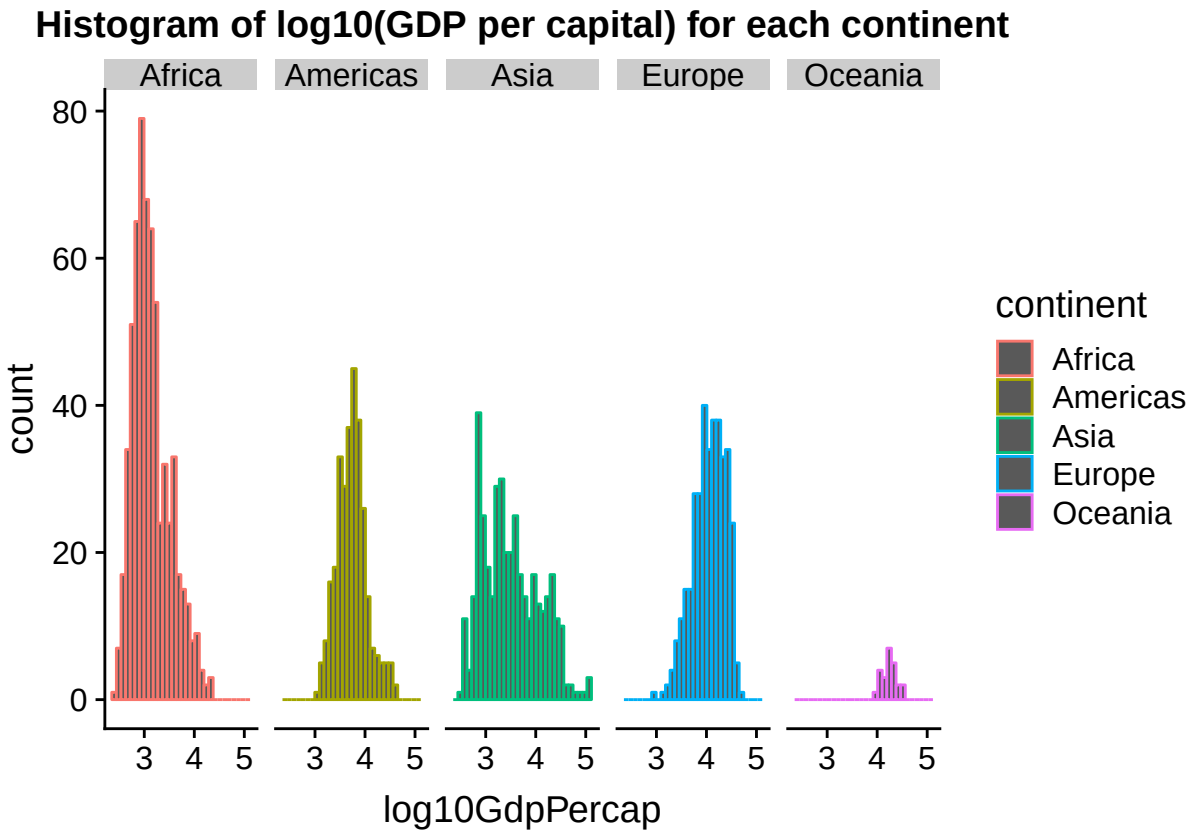
```
#use ggplot2 to create a boxplot for each continent
ggplot(gapminder, aes(continent, log10GdpPercap)) +
  geom_boxplot(aes(color = continent)) +
  ggtitle("Box plot of log10(GDP per capital) for each continent")
```



You can also visualize the spread using a histogram

```
ggplot(gapminder,aes(x=log10GdpPercap, color=continent))+
  geom_histogram() +
  facet_grid(~ continent) +
  ggtitle("Histogram of log10(GDP per capital) for each continent")
```

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



Task 3: Compute a trimmed mean of life expectancy for different years. Or a weighted mean, weighting by population.

Compute plain mean by year

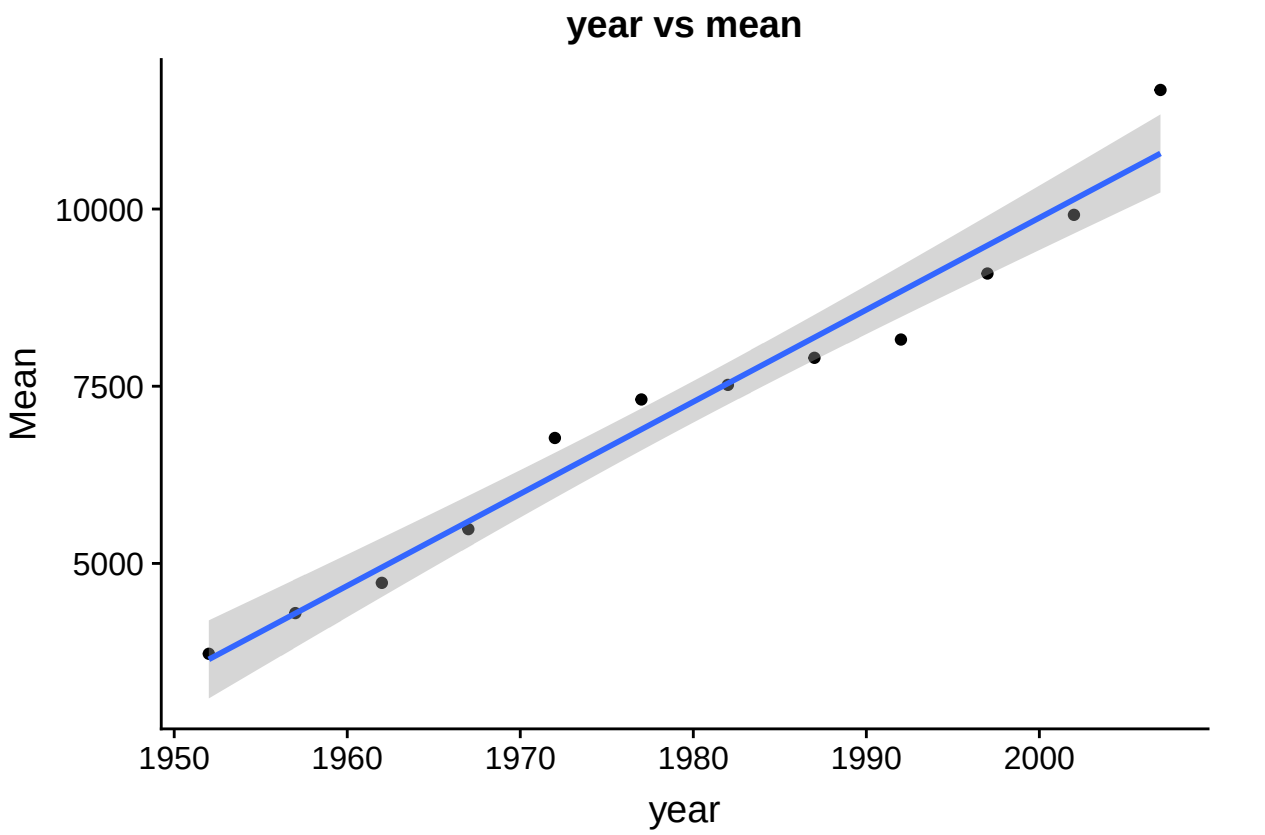
```
#group by year and compute the means just to get a feel for it
years.mean <- gapminder %>%
    group_by(year) %>%
    summarize("Mean" = mean(gdpPercap))

#Show the table
knitr::kable(years.mean)
```

year	Mean
1952	3725.276
1957	4299.408
1962	4725.812
1967	5483.653
1972	6770.083
1977	7313.166
1982	7518.902
1987	7900.920
1992	8158.609
1997	9090.175
2002	9917.848

year	Mean
2007	11680.072

We can also plot the means by year

```
plot1 <- ggplot(years.mean, aes(year, `Mean`)) +
  geom_point() +
  ggtitle("year vs mean") +
  geom_smooth(method = "lm", se = TRUE)

#show the plot
plot1
```



Now that we have the hang of things, compute the trim mean

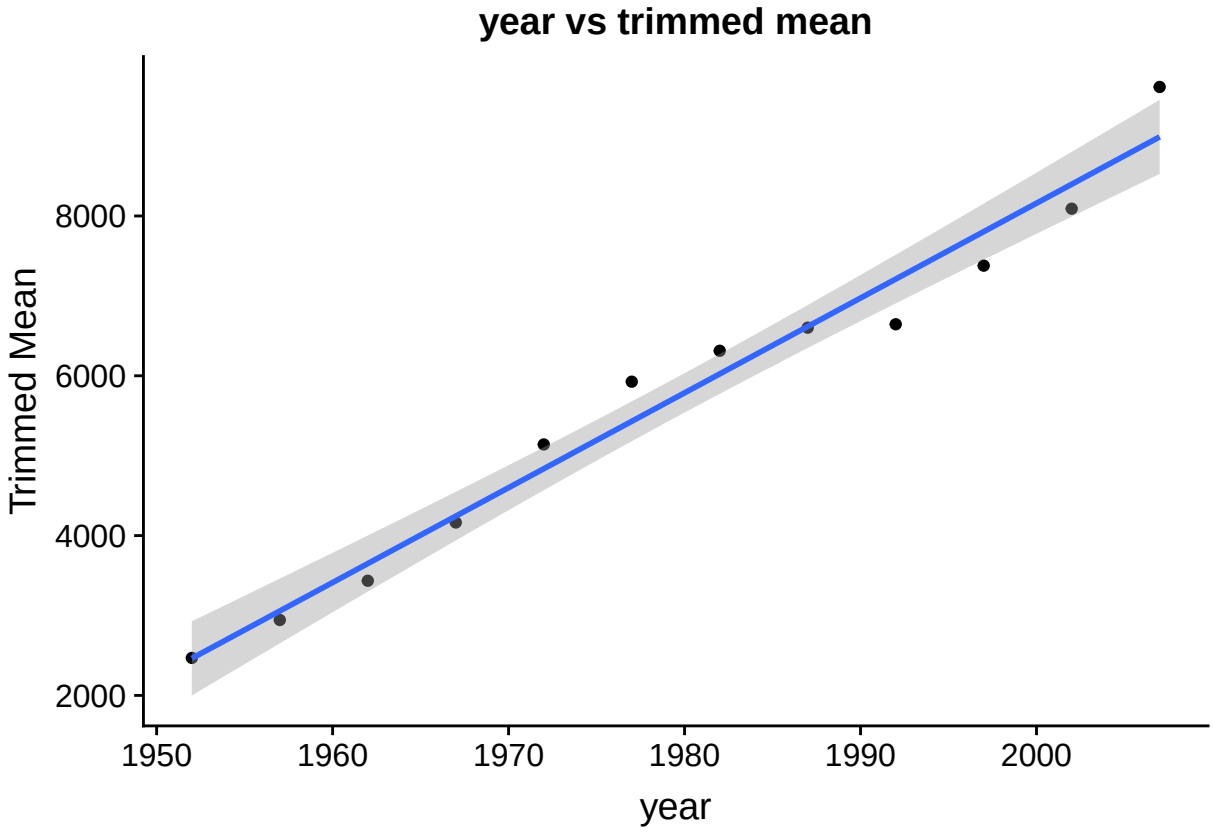
We trim by 10% so we will be discarding $1704 * 0.10 = 170$ observations

```
#Do a 10% trimmed mean
trimmed.means <- gapminder %>%
    group_by(year) %>%
    summarize("Trimmed Mean" = mean(gdpPercap, trim = 0.10))

#Show the table
knitr::kable(trimmed.means)
```

year	Trimmed Mean
1952	2469.257
1957	2944.170
1962	3434.946
1967	4163.954
1972	5140.784
1977	5925.991
1982	6312.725
1987	6602.002
1992	6645.059
1997	7378.100
2002	8090.746
2007	9614.171

plot the means by year

```
plot2 <- ggplot(trimmed.means, aes(year, `Trimmed Mean`)) +
  geom_point() +
  ggtitle("year vs trimmed mean") +
  geom_smooth(method = "lm", se = TRUE)

#show the plot
plot2
```



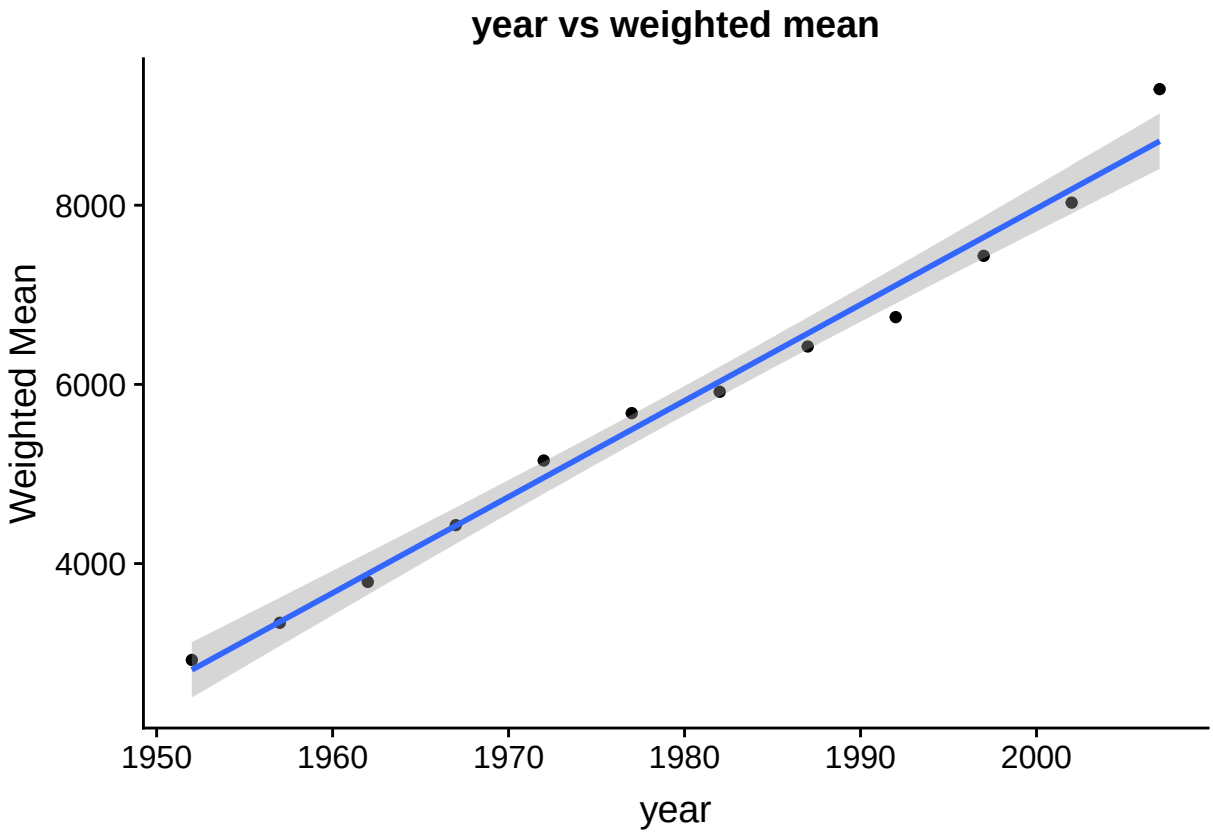
Now lets get really fancy by computing a weighted mean

```
#compute the weighted means for year
weighted.means <- gapminder %>%
    group_by(year) %>%
    summarize("Weighted Mean" = weighted.mean(gdpPercap,pop))

#Show the table
knitr::kable(weighted.means)
```

year	Weighted Mean
1952	2923.895
1957	3338.933
1962	3794.895
1967	4428.342
1972	5150.000
1977	5678.864
1982	5917.324
1987	6422.880
1992	6750.708
1997	7435.096
2002	8028.964
2007	9295.987

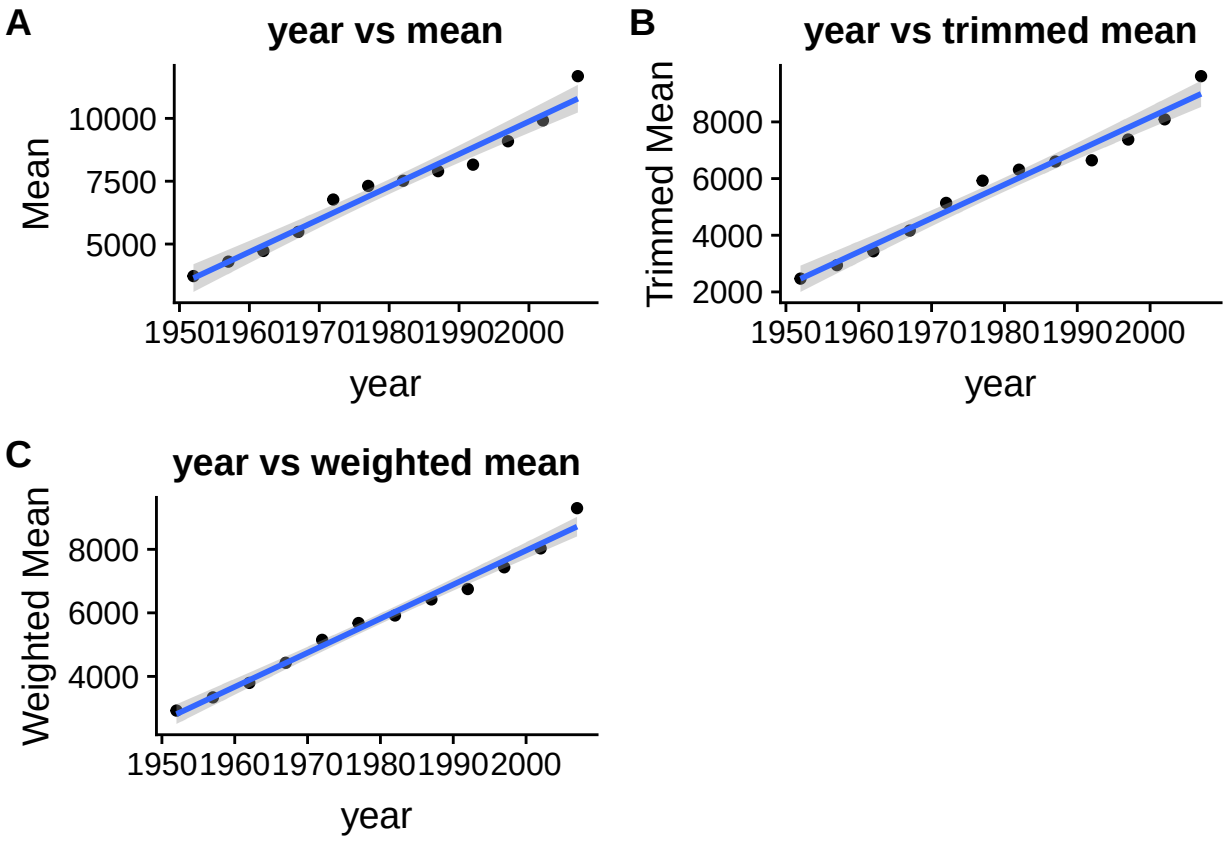
plot the means by year

```
plot3 <- ggplot(weighted.means, aes(year, `Weighted Mean`)) +
  geom_point() +
  ggtitle("year vs weighted mean") +
  geom_smooth(method = "lm", se = TRUE)

#show the plot
plot3
```



Now put all the plot side by side so it's easier to see

```
#use the plot_grid function from th cowplot library to do this
plot_grid(plot1, plot2,plot3, labels = "AUTO")
```

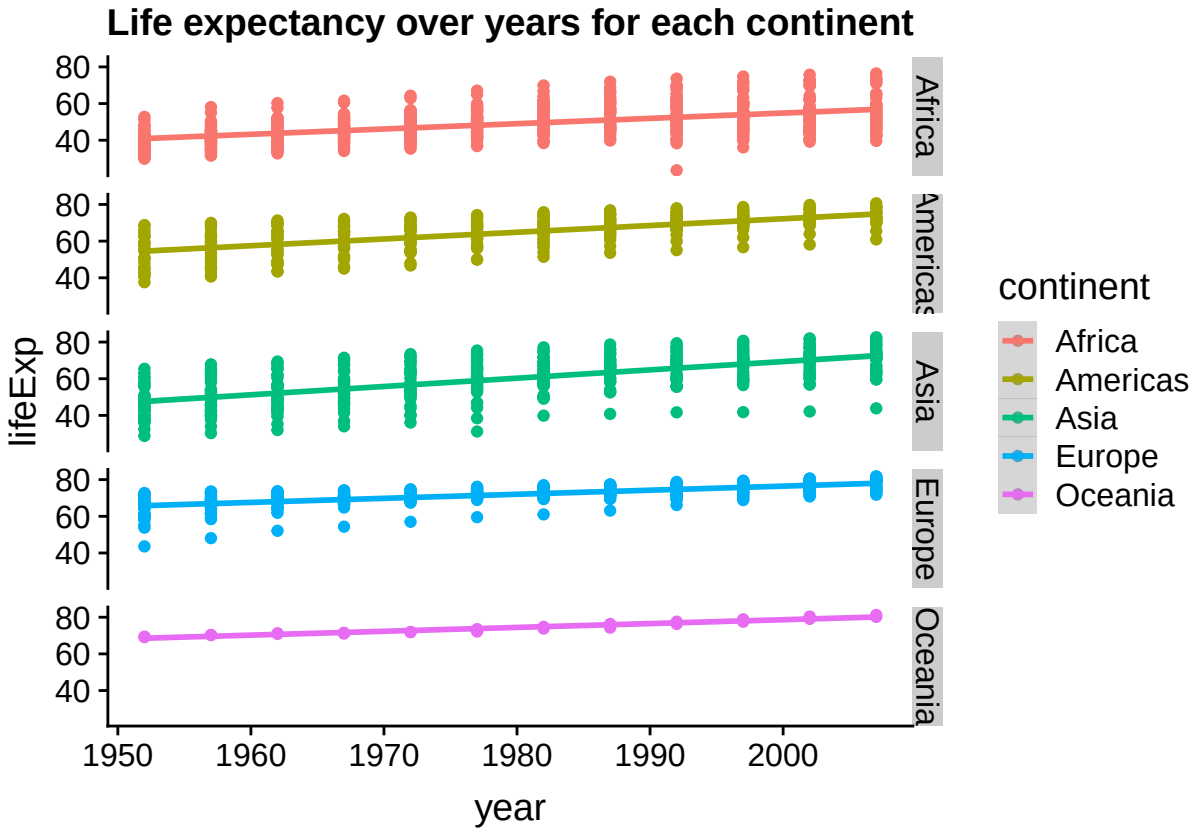


Looking at the plots above, we see that we change the trend in the means by weighting it by the poputlation. The mean is closer to a straight line. Also, the mean and the trimmed mean are not too different.

Task 4: How is life expectancy changing over time on different continents?

Here I will be using chaining and piping to plot life expectancy over time for each continent

```
gapminder %>%
  ggplot(aes(x=year,y=lifeExp,color=continent)) +
   geom_point() +
   geom_smooth(method = "lm") +
  facet_grid(continent ~ .) +
  ggtitle("Life expectancy over years for each continent")
```



It seems that on average, Oceania countries have higher life expectancy compared to other continents. I would however take this with a grain of salt as there is very little data as we can see from the plot above.

Find countries with interesting stories.

I am interested in looking at Africa as a whole. I am also interested in countries with high life expectancy (>60), and low life expectancy (<40).

First look at African countries

```
medLA <- gapminder %>%
  filter(continent == "Africa") %>%
  group_by(country) %>%
  summarise(medLifeExp = median(lifeExp))

#Show the table
knitr::kable(medLA)
```

country	medLifeExp
Algeria	59.6910
Angola	39.6945
Benin	50.0470
Botswana	52.9270
Burkina Faso	47.1295
Burundi	45.0310

country	medLifeExp
Cameroon	49.6055
Central African Republic	44.0990
Chad	48.4500
Comoros	51.9360
Congo, Dem. Rep.	45.2570
Congo, Rep.	53.9385
Cote d'Ivoire	48.1595
Djibouti	47.6655
Egypt	54.6625
Equatorial Guinea	42.8430
Eritrea	44.3385
Ethiopia	44.7130
Gabon	54.6770
Gambia	43.7110
Ghana	52.7500
Guinea	41.8265
Guinea-Bissau	38.3960
Kenya	53.8345
Lesotho	49.1295
Liberia	42.4175
Libya	59.7985
Madagascar	47.9250
Malawi	44.3880
Mali	42.8150
Mauritania	52.2255
Mauritius	65.8205
Morocco	57.6900
Mozambique	42.2885
Namibia	53.3865
Niger	41.9445
Nigeria	45.1700
Reunion	68.4745
Rwanda	43.7165
Sao Tome and Principe	59.4505
Senegal	50.6290
Sierra Leone	37.5605
Somalia	41.4735
South Africa	53.5305
Sudan	49.0690
Swaziland	48.0925
Tanzania	49.0585
Togo	54.1790
Tunisia	61.9425
Uganda	48.4380
Zambia	46.0615
Zimbabwe	53.1765

```
#get the country with max median life expectancy
knitr::kable(medLA[medLA$medLifeExp == max(medLA$medLifeExp),])
```

country	medLifeExp
Reunion	68.4745

```
#get the median life expectancy of my country "Liberia"
knitr::kable(medLA[medLA$country == "Liberia", ])
```

country	medLifeExp
Liberia	42.4175

Wow Renunion has the highest median life expectancy in Africa. I have never heard of this place before. It turns out it is an island eas of madagascar! Thats pretty cool. :smirk: The median life expectancy in my country is pretty low! I guess we have some catching up to do. :muscle:

Now look at countries with high and low life expectancy

Look at a subset of countries with the lowest and highest median life expectancies.

```
knitr::kable(filter(medLA,medLifeExp<40))
```

country	medLifeExp
Angola	39.6945
Guinea-Bissau	38.3960
Sierra Leone	37.5605

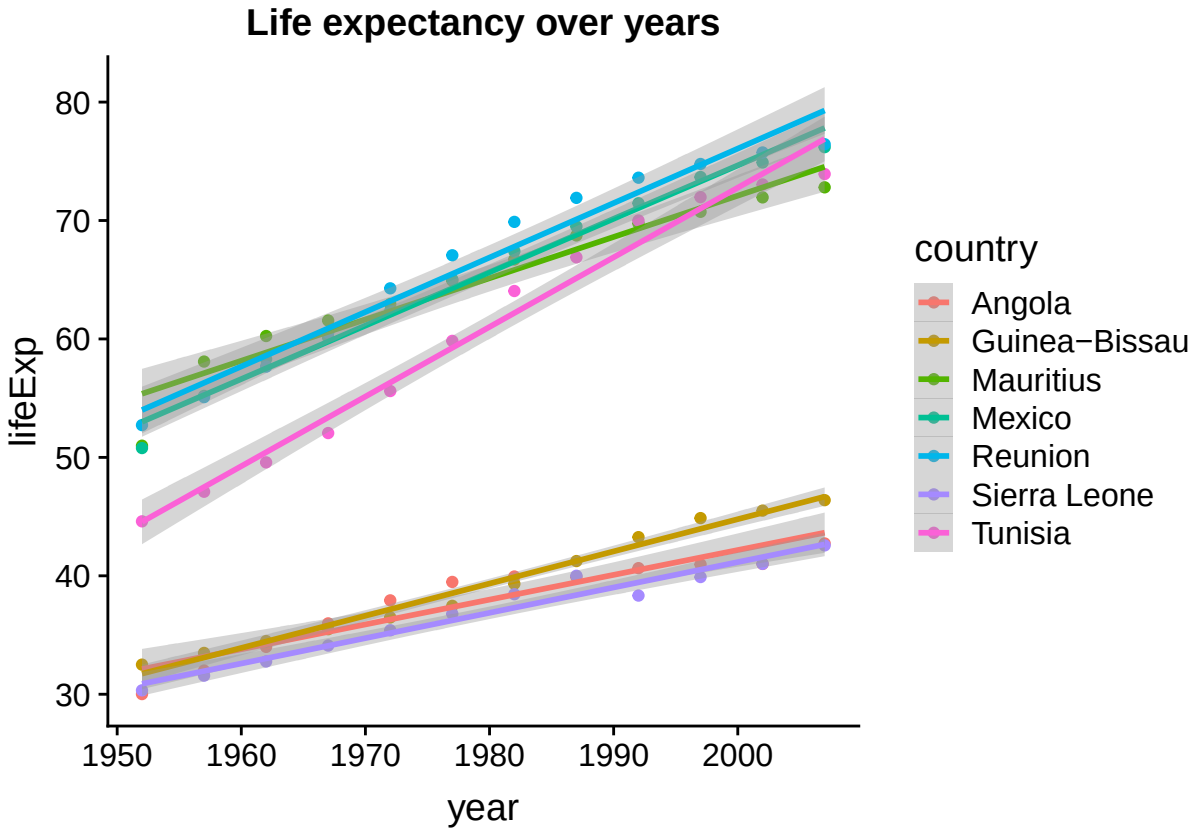
```
knitr::kable(filter(medLA,medLifeExp>60))
```

country	medLifeExp
Mauritius	65.8205
Reunion	68.4745
Tunisia	61.9425

```
cc = c("Angola","Guinea-Bissau","Sierra Leone",
       "Mauritius","Reunion","Tunisia",
       "Mexico") # Mexico for comparison
```

Plot life expectancy over time.

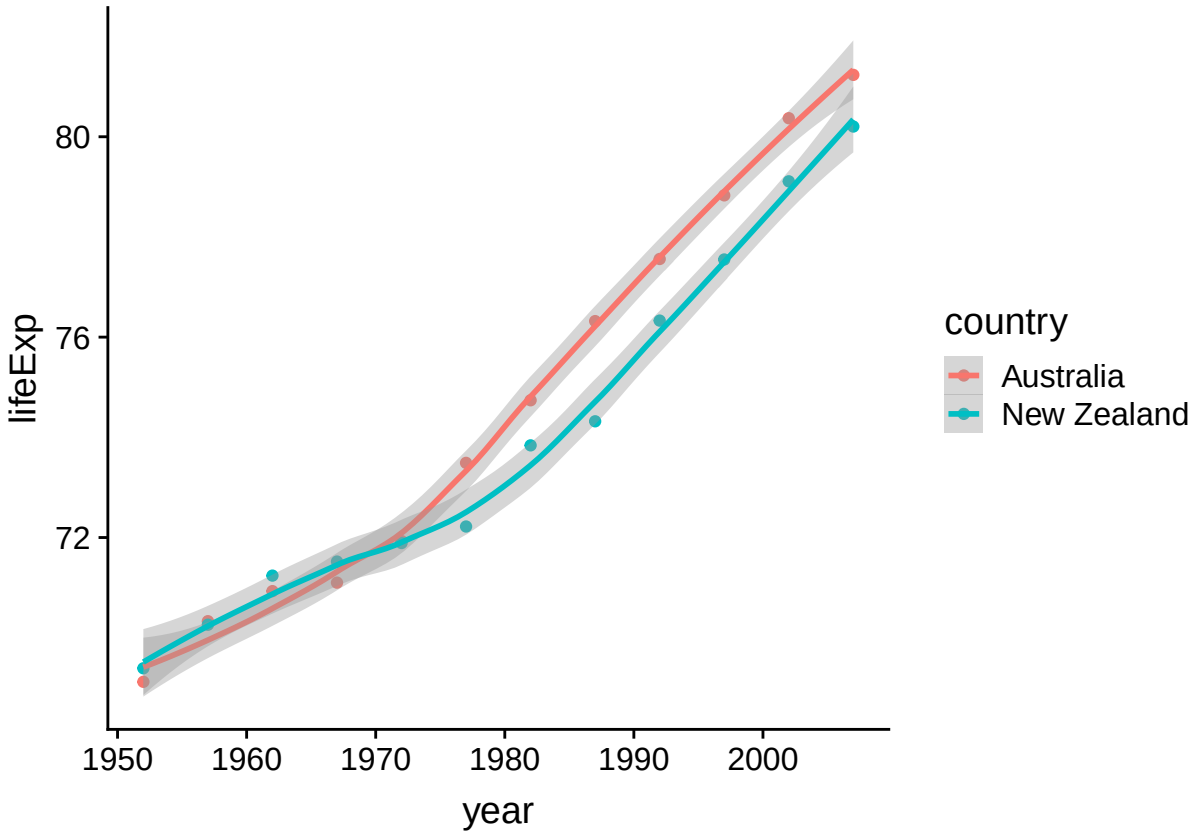
```
gapminder %>%
  filter(country %in% cc) %>%
  ggplot(aes(x=year,y=lifeExp,color=country)) +
   geom_point() +
   geom_smooth(method = "lm") +
  ggtitle("Life expectancy over years")
```



It is quite interesting to see the massive disparity between a set of countries in Africa. I guess the quality of life does play a key role in life expectancy. A few countries have some catching up to do! :pensive:

Just before I finish, here's another interesting plot of life expectancy over time:

```
gapminder %>%
  filter(continent == "Oceania") %>%
  ggplot(aes(x=year,y=lifeExp,color=country)) +
  geom_point() +
  geom_smooth(method = "loess", span=3/4)
```



Hmm What happend in the mid-1970s in Australia? :worried: