Lesson 4: Data

Daniel Stoxreiter

all code was generated in collaboration with colleagues of the R course

```
# Loading the bagdad-london--finalRestat.dta data
library(haven)
```

```
## Warning: package 'haven' was built under R version 3.5.3
```

```
bagdad_london_finalRestat <- read_dta("~/R_course/lession4/Bosker_Data/bagdad-london--finalRestat.dta")
```

What is the chronological extent of this data?

```
# returns the earliest year of the database
min(bagdad_london_finalRestat$year)
```

```
## [1] 800
```

```
# returns the latest year of the database
max(bagdad_london_finalRestat$year)
```

```
## [1] 1800
```

```
# returns a summary of the database
summary(bagdad_london_finalRestat$year)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##     800    1000    1300    1300    1600    1800
```

What periods can it be divided into? How can we do that?

The data can be devided into early medieval period, late medieval period, early modern period and late modern period. As an example the data is divided into oly two periods: Medieval and Modern.

```
# Medieval period which is everything in the database dated prior and equal 1500.
Medieval.bagdad.sub <- subset(bagdad_london_finalRestat,  bagdad_london_finalRestat$year <= 1500)
head(Medieval.bagdad.sub, 10)
```

```
## # A tibble: 10 x 69
##    indicator city  country  year arab_peninsula latitude longitude
##        <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
##  1         1 Graz  Austria   800              0     47.1      15.4
##  2         2 Inns~ Austria   800              0     47.3      11.4
```

```
##  3         3 Klag~ Austria   800              0     46.6     14.3
##  4         4 Linz  Austria   800              0     48.3     14.3
##  5         5 Salz~ Austria   800              0     47.8     13.0
##  6         6 Wien~ Austria   800              0     48.2     16.4
##  7         7 Aals~ Belgium   800              0     50.9      4.03
##  8         8 Antw~ Belgium   800              0     51.2      4.42
##  9         9 Brug~ Belgium   800              0     51.2      3.23
## 10        10 Brux~ Belgium   800              0     50.8      4.33
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
tail(Medieval.bagdad.sub, 10)
```

```
## # A tibble: 10 x 69
##    indicator city  country  year arab_peninsula latitude longitude
##        <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
##  1       784 Medi~ Egypt    1500              0     29.3      30.8
##  2       785 Mans~ Egypt    1500              0     31.1      31.7
##  3       786 Bilb~ Egypt    1500              0     30.4      31.6
##  4       787 Dama~ Egypt    1500              0     31.0      30.5
##  5       788 Menu~ Egypt    1500              0     30.5      30.9
##  6       789 Asyu~ Egypt    1500              0     27.2      31.2
##  7       790 Aswa~ Egypt    1500              0     24.1      32.9
##  8       791 Kina~ Egypt    1500              0     32.7      26.2
##  9       792 Qaly~ Egypt    1500              0     30.2      31.2
## 10       793 Tant~ Egypt    1500              0     30.8      31
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
```

```
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
# Modern period which is everything after 1500.
Modern.bagdad.sub <- subset(bagdad_london_finalRestat,  bagdad_london_finalRestat$year > 1500)
head(Modern.bagdad.sub, 10)
```

```
## # A tibble: 10 x 69
##    indicator city  country  year arab_peninsula latitude longitude
##        <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
##  1         1 Graz  Austria  1600              0     47.1     15.4
##  2         2 Inns~ Austria  1600              0     47.3     11.4
##  3         3 Klag~ Austria  1600              0     46.6     14.3
##  4         4 Linz  Austria  1600              0     48.3     14.3
##  5         5 Salz~ Austria  1600              0     47.8     13.0
##  6         6 Wien~ Austria  1600              0     48.2     16.4
##  7         7 Aals~ Belgium  1600              0     50.9      4.03
##  8         8 Antw~ Belgium  1600              0     51.2      4.42
##  9         9 Brug~ Belgium  1600              0     51.2      3.23
## 10        10 Brux~ Belgium  1600              0     50.8      4.33
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
```

```
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
tail(Modern.bagdad.sub, 10)
```

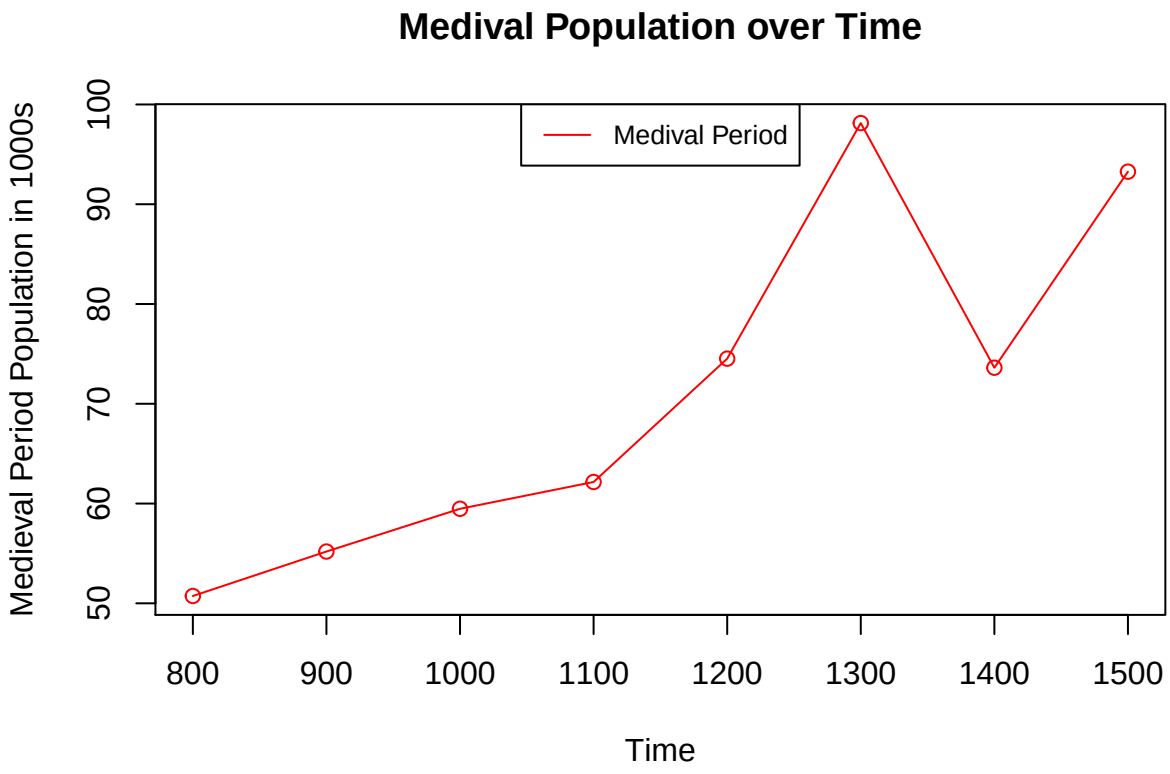
```
## # A tibble: 10 x 69
##    indicator city  country  year arab_peninsula latitude longitude
##        <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
##  1       784 Medi~ Egypt    1800              0     29.3      30.8
##  2       785 Mans~ Egypt    1800              0     31.1      31.7
##  3       786 Bilb~ Egypt    1800              0     30.4      31.6
##  4       787 Dama~ Egypt    1800              0     31.0      30.5
##  5       788 Menu~ Egypt    1800              0     30.5      30.9
##  6       789 Asyu~ Egypt    1800              0     27.2      31.2
##  7       790 Aswa~ Egypt    1800              0     24.1      32.9
##  8       791 Kina~ Egypt    1800              0     32.7      26.2
##  9       792 Qaly~ Egypt    1800              0     30.2      31.2
## 10       793 Tant~ Egypt    1800              0     30.8      31
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

Can you generate a cumulative graph of population over time, divided into these periods? (Hint: there should be one line for one period and another for another, etc.)

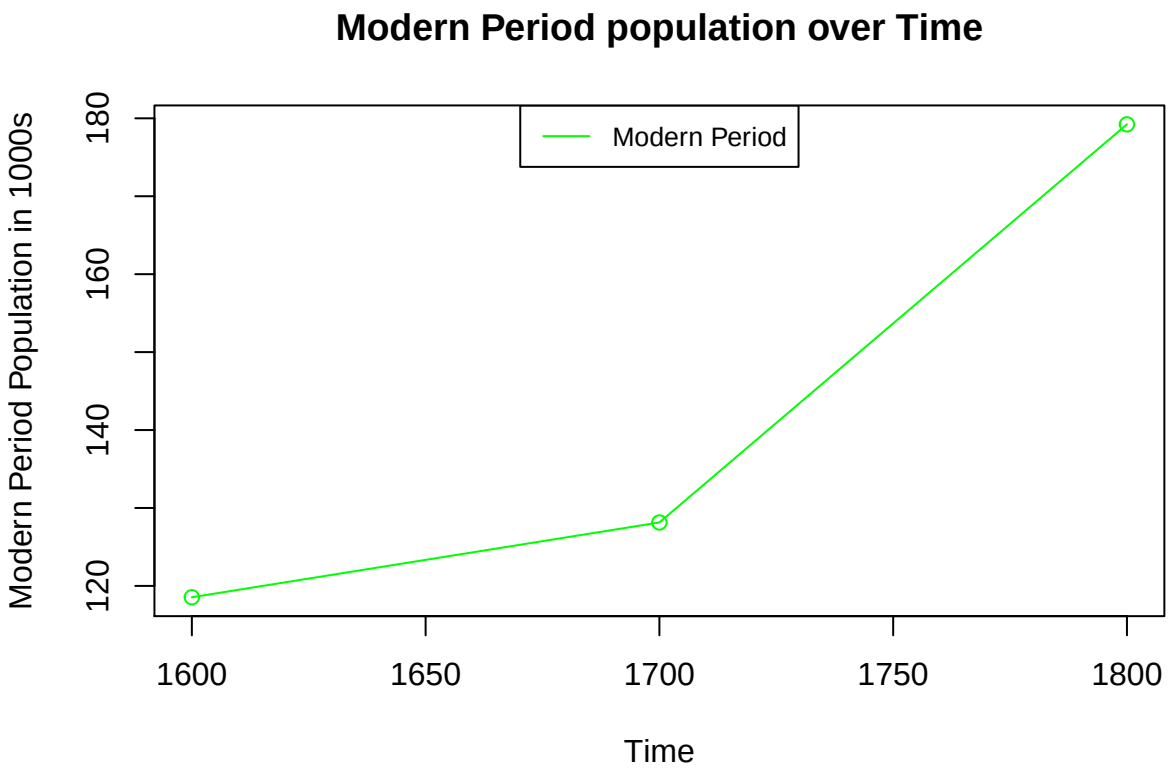
```
# Medieval period which is everything in the database dated prior and equal 1500.
Medieval.bagdad.sub <- subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year <= 1500)
# Modern period which is everything after 1500.
Modern.bagdad.sub <- subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year > 1500)
```

```r
# Creates a new dataframe for the Medieval period with three variables only (year, country and pop = po
data.frame.Medieval <- data.frame("year" = Medieval.bagdad.sub$year, "country" = Medieval.bagdad.sub$cou
# Creates a new dataframe for the Modern period with three variables only (year, country and pop = popu
data.frame.Modern <- data.frame("year" = Modern.bagdad.sub$year, "country" = Modern.bagdad.sub$country,
# Removes all duplicates from the dataset for the Medieval period
uniqueMedieval = unique(data.frame.Medieval[c("year", "country", "pop")])
# Creates a sum by aggregating the poulation of the country by year for the Medieval period.
aggMedieval = aggregate(uniqueMedieval$pop, by=list(Category=uniqueMedieval$year), FUN=sum)
# Removes all duplicates from the dataset for the Modern period
uniqueModern = unique(data.frame.Modern[c("year", "country", "pop")])
# Creates a sum by aggregating the poulation of the country by year for the Modern period.
aggModern = aggregate(uniqueModern$pop, by=list(Category=uniqueModern$year), FUN=sum)

# Plotting:
# Creates a single plot of the Medieval period population over time
plot(x = aggMedieval$Category, y = aggMedieval$x / 1000, type = "o", col="red", ylab = "Medieval Period
# Legend on top of the graph
legend("top", legend=c("Medival Period"),col=c("red"), lty = 1:2, cex=0.8)
```




```r
plot(x = aggModern$Category, y = aggModern$x / 1000, type = "o", col="green", ylab = "Modern Period Popu
# Legend on top of the graph
legend("top", legend=c("Modern Period"),col=c("green"), lty = 1:2, cex=0.8)
```



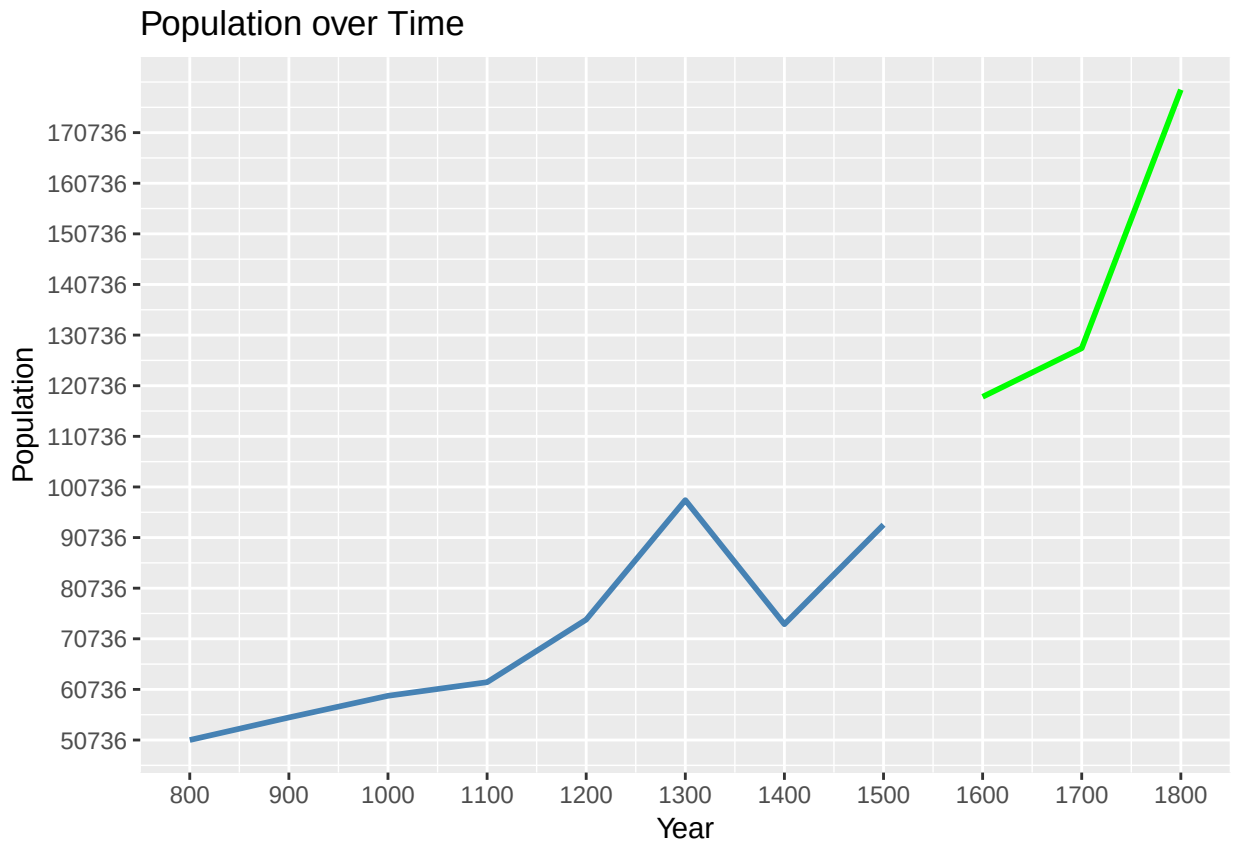
Combined graph of Medieval and the Modern period and their populaton over time

```
medieval_population <- Medieval.bagdad.sub$citypop_le5
range_population_medieval <- range(Medieval.bagdad.sub$citypop_le5)
range_population_modern <- range(Modern.bagdad.sub$citypop_le5)
range_year_modern <- range(Modern.bagdad.sub$year)
years_medival_modern <- unique(bagdad_london_finalRestat$year)

library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.5.3
```

```
ggplot() +
  geom_line(data = aggMedieval, aes(y = aggMedieval$x, x= aggMedieval$Category), size=1, color ="steelbl
  geom_line(data= aggModern, aes(y = aggModern$x, x= aggModern$Category), size= 1, color ="green") +
  xlab("Year") + ylab("Population") +
  ggtitle("Population over Time") +
  scale_x_continuous(breaks =round(seq(min(years_medival_modern), max(years_medival_modern), by = 100),1
    scale_y_continuous(breaks = round(seq(min(aggMedieval$x), max(aggModern$x), by =10000),1)) +
  scale_color_discrete(name="Period",  labels = c("Modern Population", "Medival Population"))
```



North Africa and Europe?

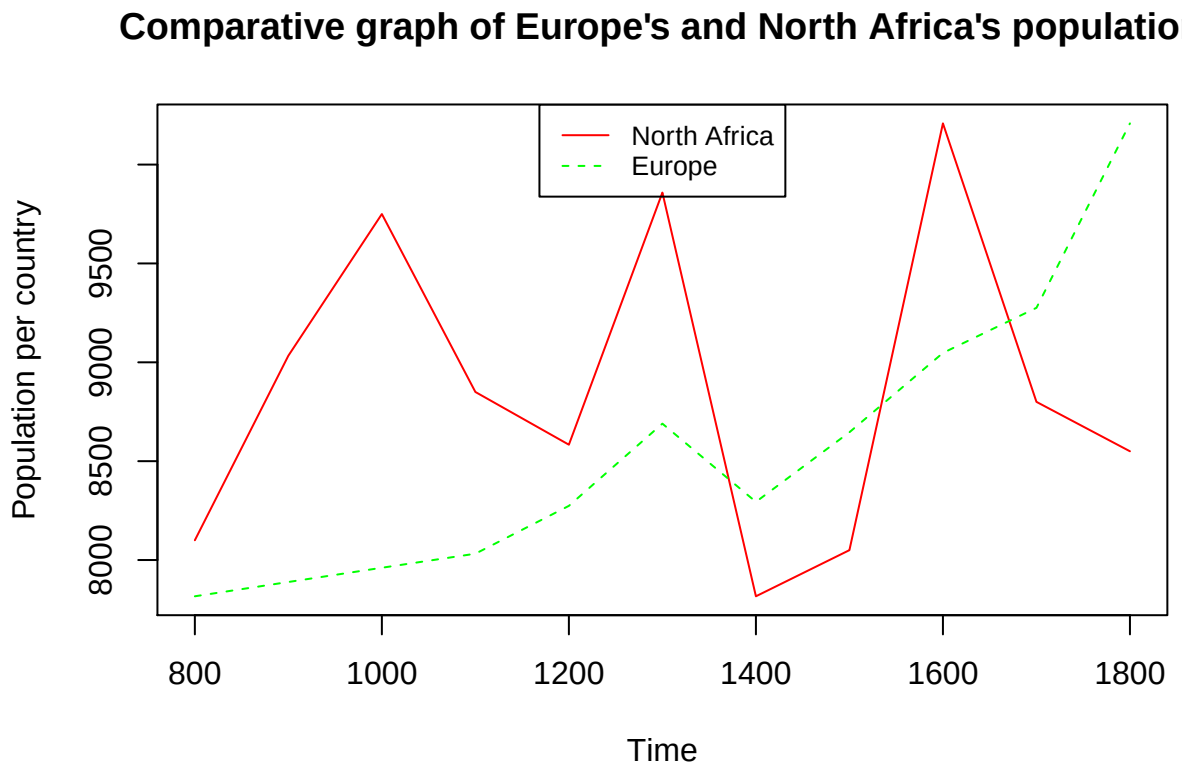
Can you construct comparative graphs of population in North Africa and Europe (similar to what you did with the Morris dataset). Here you will need to sum up population!

```
# creates a vectors with unique countries from the main database
unique_countries <- unique(bagdad_london_finalRestat$country)
# vectors of european countries only
Europevector <- c("Austria", "Ireland", "Belgium", "Czech rep.", "Denmark", "Finland", "France", "Germa
# vector of north african countries only
NorthAfricavector <- c("Morocco", "Tunesia", "Lybia", "Egypt", "Syria")
# compares the main database with the Europevector and stores information in a new dataframe with value
Europe.bagdad <- bagdad_london_finalRestat[bagdad_london_finalRestat$country %in% Europevector, ]
# compares the main database with the NorthAfricavector and stores information in a new dataframe with
NorthAfrica.bagdad <- bagdad_london_finalRestat[bagdad_london_finalRestat$country %in% NorthAfricavecto
```

```
# creates a new dataframe for european countries only with three variables (year, country and pop = pop
data.frame.europe <- data.frame("year" = Europe.bagdad$year, "country" = Europe.bagdad$country, "pop" =
# creates a new dataframe for north african countries only with three variables (year, country and pop
data.frame.Africa <- data.frame("year" = NorthAfrica.bagdad$year, "country" = NorthAfrica.bagdad$countr
# stores unique values of the columns year, country and pop and stores it in a dataframe
uniqueAfrica = unique(data.frame.Africa[c("year", "country", "pop")])
# creates a sum by aggregating the poulation of the country by year for north african countries.
aggAfrica = aggregate(uniqueAfrica$pop, by=list(Category=uniqueAfrica$year), FUN=sum)
```

```r
# stores unique values of the columns year, country and pop and stores it in a dataframe
uniqueEurope = unique(data.frame.europe[c("year", "country", "pop")])
# creates a sum by aggregating the poulation of the country by year for european countries.
aggEurope = aggregate(uniqueEurope$pop, by=list(Category=uniqueEurope$year), FUN=sum)

#Plotting:
# comparative graphs of population in North Africa and Europe
plot(x = aggAfrica$Category, y = aggAfrica$x, type = "l", col="red", ylab = "Population per country", xl
par(new = TRUE)
plot(x = aggEurope$Category, y = aggEurope$x, type = "l", col="green", axes = FALSE, xlab = " ", ylab =
legend("top", legend=c("North Africa", "Europe"),col=c("red", "green"), lty = 1:2, cex=0.8)
```



Austro-Hungarian Empire

When did the Empire had the largest number of cities (based on the data set)?

```r
# Trials, not need for the answer

# Excludes all data before year 1500 from the database
habsburg <- bagdad_london_finalRestat[bagdad_london_finalRestat$year>=1500, c('city', 'country', 'year'
# vector for countries to be excluded
exclude_countries <- c("Belgium", "Denmark", "Finland", "France", "Ireland", "Netherlands", "Norway", "
# compares the data in the habsburg variable with the exclue_countries vector and keeps cuntries that a
```

```r
habsburg <- habsburg[!(habsburg$country %in% exclude_countries), ]

# answer of the initial questions followes here:

library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.5.3
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
# Habsburg at the 15 cent. Just country selection, but the way you do it is the same
habsburg_15_century <- c("Austria", "Spain", "France", "Italy","Belgium", "Netherlands", "Yugoslavia")
habsburg_frame_15 <- subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1500)
habsburg_frame_15 <- habsburg_frame_15[(habsburg_frame_15$country %in% habsburg_15_century), ]
habsburg_frame_15 %>% count(habsburg_frame_15$year)
```

```
## # A tibble: 1 x 2
##   `habsburg_frame_15$year`     n
##                      <dbl> <int>
## 1                     1500   426
```

```r
# Habsburg at the 16 cent. Just country selection, but the way you do it is the same
habsburg_16_century <- c("Austria", "Hungary", "Italy", "Slovakia", "Czech rep.", "Rumenia", "Serbia",
habsburg_frame_16 <- subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1600)
habsburg_frame_16 <- habsburg_frame_16[(habsburg_frame_16$country %in% habsburg_16_century), ]
habsburg_frame_16 %>% count(habsburg_frame_16$year)
```

```
## # A tibble: 1 x 2
##   `habsburg_frame_16$year`     n
##                      <dbl> <int>
## 1                     1600   537
```

```r
#Habsburg at the 17 cent. Just country selection, but the way you do it is the same
habsburg_17_century <- c("Austria", "Hungary", "Italy", "Slovakia", "Czech rep.", "Rumenia", "Serbia",
habsburg_frame_17 <- subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1700)
habsburg_frame_17 <- habsburg_frame_17[(habsburg_frame_17$country %in% habsburg_17_century), ]
max_17 = nrow(habsburg_frame_17)
habsburg_frame_17 %>% count(habsburg_frame_17$year)
```

```
## # A tibble: 1 x 2
##   `habsburg_frame_17$year`     n
##                      <dbl> <int>
## 1                     1700   249
```

```r
#Habsburg at the 18 cent. Just country selection, but the way you do it is the same
habsburg_18_century <- c("Austria", "Hungary", "Italy", "Slovakia", "Czech rep.", "Rumenia", "Yugoslavi
habsburg_frame_18 <- subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1800)
habsburg_frame_18 <- habsburg_frame_18[(habsburg_frame_18$country %in% habsburg_18_century), ]
# nrow(habsburg_frame_18) works also and is simpler
habsburg_frame_18 %>% count(habsburg_frame_18$year)
```

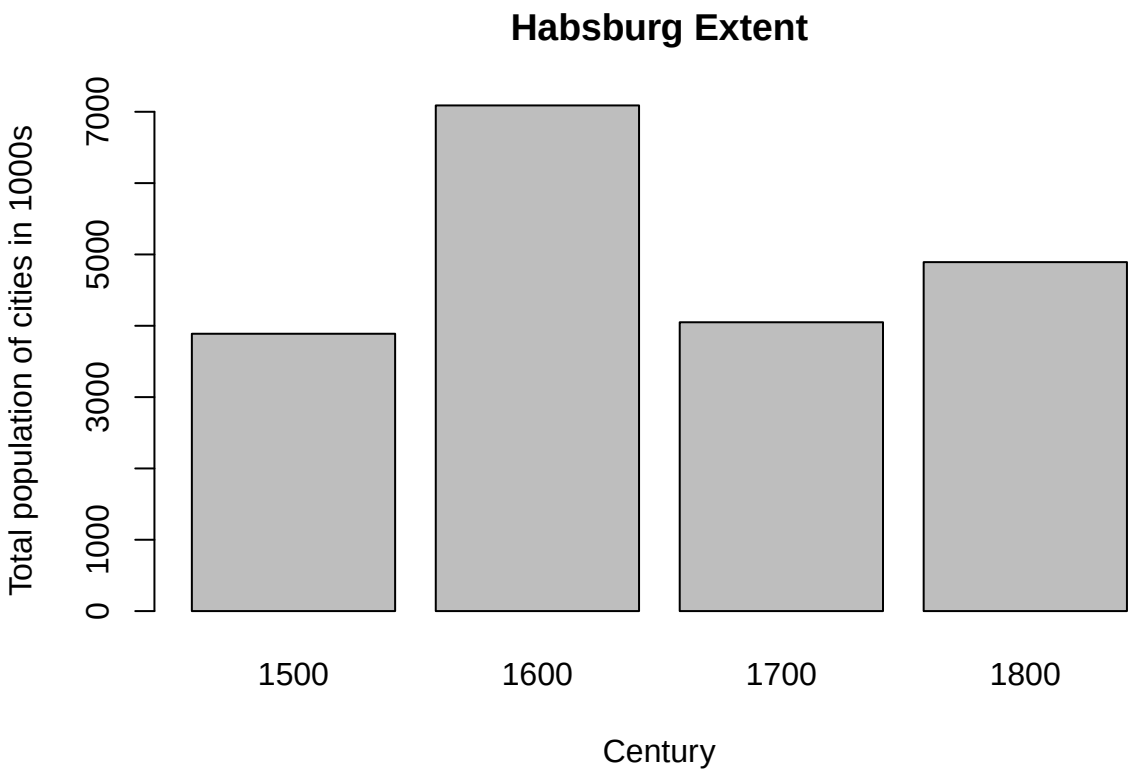
```
## # A tibble: 1 x 2
##   `habsburg_frame_18$year`     n
##                      <dbl> <int>
## 1                     1800   222
```

When was its population at the highest?

Well simplest solution, sum up every citi_pop_le5 and multiply by 1000.

```r
# creating a sum for all the population based on cities of habsburg countries from specific centuries.
pop_h_15 <- sum(habsburg_frame_15$citypop_le5)
pop_h_16 <- sum(habsburg_frame_16$citypop_le5)
pop_h_17 <- sum(habsburg_frame_17$citypop_le5)
pop_h_18 <- sum(habsburg_frame_18$citypop_le5)
# creates a vector of all sums
max_habsburg = c(pop_h_15, pop_h_16, pop_h_17, pop_h_18)
# creates a vector for selected centuries for the plot
century <- c(1500, 1600, 1700, 1800)

# Plotting:
barplot(max_habsburg, main = "Habsburg Extent", xlab = "Century", ylab = "Total population of cities in
```



Christendom and Islam

What are the largest cities of Islamdom for each reported period?

- We start out by creating an Islamdom dataset.
- We remove all countries that were at no point part of Islamdom.
- Add a variable: Islamdom.
- For any and all cities that are part of a core of Islamdom, we give this variable a value of 1 for all centuries.
- For cities that are only a part of Islamdom in specific timeframes we make that variable 1 for those times when it was a part of the empire.
- We remove all cities that were never part of Islamdom.
- We can then apply max() to the populations of any given time period - again, by subsetting to restrict the timeframe.
- What are the largest western cities of Islamdom between 1000 and 1500 CE?
- This is somewhat dependent upon what this question means.
- If the question is simply about which were the largest cities that were muslim in what we consider the West, it's easy.
- We restrict the dataset to the west, and to 1000 to 1500, sort out any cities across all periods that were not muslim (using the muslim variable) and there we have it. A list of all muslim cities in the west, to be sorted by size if so desired. If the question is then of largest and at what time, that can be printed out. If the question is simply which were the largest, a unique() list of cities sorted by size (greater than an arbitrary mark) will provide all fitting cities.

- If, however, the question is about the extent of Islamdom, we need to create a full reconstruction of Islamdom, then examine its western reaches city by city for the largest.

Biggest muslim cities in Europe between 1000 and 1500.

```
# creates a dataframe with variables year, country, city, citypop (population) and muslim for filtering
IslamEurop.frame = data.frame("year" = Europe.bagdad$year, "country" = Europe.bagdad$country, "city" = I
# filters for entries with the yeaer equal or greater than 1000
IslamEurop.frame.1000 <- IslamEurop.frame[IslamEurop.frame$year >= 1000 & IslamEurop.frame$year <= 1500
# filters for entries with the yeaer less or equal 1500
#IslamEurop.frame.1500 <- IslamEurop.frame.1000[IslamEurop.frame.1000$year <= 1500, ]
# filters for cities that are muslim cities
IslamEurope.fram.Islam <- IslamEurop.frame[IslamEurop.frame$muslim == 1, ]
# filters for cities with a population grater 20000
IslamEurope.fram.Islam.Pop <- IslamEurope.fram.Islam[IslamEurope.fram.Islam$Citypop > 20, ]
# filters for cities that are not turkey
IslamEurope.fram.Islam.Pop.Oops <- IslamEurope.fram.Islam.Pop[IslamEurope.fram.Islam.Pop$country != "Tu
# head of the final result
head(unique(IslamEurope.fram.Islam.Pop.Oops$city), 10)
```

```
##  [1] Barbastro                   Cordoba (Kurtuba)
##  [3] Merida (Marida)             Sevilla(Seville, Ishbiliya)
##  [5] Toledo                      Palermo (Balarm)
##  [7] Almeria (Al-Mariyya)        Cartagena (Kartadjanna)
##  [9] Granada (Gharnata)          Palma
## 721 Levels: (Gazi)Antep (Ayntab, Antaph, Hamtab, Ayintab) ... Zwolle
```

Biggest cities before 1500 the period split

```
# creates a dataframe with variables year, country, city, citypop (population) and muslim for filtering
Islam.Beta <- data.frame("year" = bagdad_london_finalRestat$year, "city" = bagdad_london_finalRestat$ci
# filters for cities that are muslim cities
Islam.Frame <- Islam.Beta[Islam.Beta$muslim == 1, ]
# filters for entries with the year less or equal 1500
Islam.Frame.Pre1500 <- Islam.Frame[Islam.Frame$year <= 1500, ]
# filters for cities with a population grater 20000
Islam.Frame.Pre1500.Pop <- Islam.Frame.Pre1500[Islam.Frame.Pre1500$CityPop > 20, ]
# head of the final result
head(unique(Islam.Frame.Pre1500.Pop$city), 10)
```

```
##  [1] Barbastro
##  [2] Cordoba (Kurtuba)
##  [3] Merida (Marida)
##  [4] Sevilla(Seville, Ishbiliya)
##  [5] Toledo
##  [6] Raqqa (Er-Raqqa, Rakka, Nikephorium)
##  [7] Damascus (Dimaskh, Es-Sham)
##  [8] Baghdad (Bagdad)
##  [9] Kufa
## [10] Basra (Al-Basra)
## 792 Levels: (Gazi)Antep (Ayntab, Antaph, Hamtab, Ayintab) ... Zwolle
```

Biggest cities after 1500 the period split

```
# filters for entries with the year greater or equal 1500
Islame.Frame.Post1500 <- Islam.Frame[Islam.Frame$year >= 1500, ]
# filters for cities with a population grater 20000
Islam.Frame.Post1500.Pop <- Islam.Frame.Pre1500[Islam.Frame.Pre1500$CityPop > 20, ]
# head of the final result
head(unique(Islam.Frame.Post1500.Pop$city), 10)
```

```
##  [1] Barbastro
##  [2] Cordoba (Kurtuba)
##  [3] Merida (Marida)
##  [4] Sevilla(Seville, Ishbiliya)
##  [5] Toledo
##  [6] Raqqa (Er-Raqqa, Rakka, Nikephorium)
##  [7] Damascus (Dimaskh, Es-Sham)
##  [8] Baghdad (Bagdad)
##  [9] Kufa
## [10] Basra (Al-Basra)
## 792 Levels: (Gazi)Antep (Ayntab, Antaph, Hamtab, Ayintab) ... Zwolle
```

Another code example

```
#Largest cities of Islamdom for each reported period
head(bagdad_london_finalRestat)
```

```
## # A tibble: 6 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1         1 Graz  Austria   800              0     47.1      15.4
## 2         2 Inns~ Austria   800              0     47.3      11.4
## 3         3 Klag~ Austria   800              0     46.6      14.3
## 4         4 Linz  Austria   800              0     48.3      14.3
## 5         5 Salz~ Austria   800              0     47.8      13.0
## 6         6 Wien~ Austria   800              0     48.2      16.4
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
```

```
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
acht<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 800)
neun<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 900)
t<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1000)
teins<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1100)
tzwei<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1200)
tdrei<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1300)
tvier<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1400)
tfunf<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1500)
tsechs<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1600)
tsieben<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1700)
tacht<-subset(bagdad_london_finalRestat, bagdad_london_finalRestat$year == 1800)
achtmuslcit<-subset(acht, acht$muslim==1)
max(achtmuslcit$citypop_le10)
```

```
## [1] 350
```

```
neunmuslcit<-subset(neun, neun$muslim==1)
max(neunmuslcit$citypop_le10)
```

```
## [1] 450
```

```
tmuslcit<-subset(t, t$muslim==1)
max(tmuslcit$citypop_le10)
```

```
## [1] 300
```

```
teinsmuslcit<-subset(teins, teins$muslim==1)
max(teinsmuslcit$citypop_le10)
```

```
## [1] 250
```

```
tzweimuslcit<-subset(tzwei, tzwei$muslim==1)
max(tzweimuslcit$citypop_le10)
```

```
## [1] 200
```

```
tdreimuslcit<-subset(tdrei, tdrei$muslim==1)
max(tdreimuslcit$citypop_le10)
```

```
## [1] 220
```

```
tviermuslcit<-subset(tvier, tvier$muslim==1)
max(tviermuslcit$citypop_le10)
```

```
## [1] 250
```

```
tfunfmuslcit<-subset(tfunf, tfunf$muslim==1)
max(tfunfmuslcit$citypop_le10)
```

```
## [1] 280
```

```
tsechsmuslcit<-subset(tsechs, tsechs$muslim==1)
max(tsechsmuslcit$citypop_le10)
```

```
## [1] 700
```

```
tsiebenmuslcit<-subset(tsieben, tsieben$muslim==1)
max(tsiebenmuslcit$citypop_le10)
```

```
## [1] 700
```

```
tachtmuslcit<-subset(tacht, tacht$muslim==1)
max(tachtmuslcit$citypop_le10)
```

```
## [1] 500
```

```
library(dplyr)
cityacht<-filter(achtmuslcit, achtmuslcit$citypop_le10>=350)
cityacht
```

```
## # A tibble: 1 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       619 Bagh~ Iraq      800              0     33.3      44.4
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
```

```
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
cityneun<-filter(neunmuslcit, neunmuslcit$citypop_le10>=450)
cityneun
```

```
## # A tibble: 1 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       619 Bagh~ Iraq      900              0     33.3      44.4
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
citytausend<-filter(tmuslcit, tmuslcit$citypop_le10>=300)
citytausend
```

```
## # A tibble: 1 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       619 Bagh~ Iraq     1000              0     33.3      44.4
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
```

```
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
citytausendein<-filter(teinsmuslcit, teinsmuslcit$citypop_le10>=250)
citytausendein
```

```
## # A tibble: 1 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       619 Bagh~ Iraq     1100              0     33.3      44.4
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
citytausendzwei<-filter(tzweimuslcit, tzweimuslcit$citypop_le10>=200)
citytausendzwei
```

```
## # A tibble: 2 x 69
##   indicator city  country  year arab_peninsula latitude longitude
```

```
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       619 Bagh~ Iraq     1200              0     33.3      44.4
## 2       624 Fust~ Egypt    1200              0     30.0      31.2
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
citytausenddrei<-filter(tdreimuslcit, tdreimuslcit$citypop_le10>=220)
citytausenddrei
```

```
## # A tibble: 1 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       624 Fust~ Egypt    1300              0     30.0      31.2
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
```

```
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```

```
citytausendvier<-filter(tviermuslcit, tviermuslcit$citypop_le10>=250)
citytausendfunf<-filter(tfunfmuslcit, tfunfmuslcit$citypop_le10>=280)
citytausendsechs<-filter(tsechsmuslcit, tsechsmuslcit$citypop_le10>=700)
citytausendsieben<-filter(tsiebenmuslcit, tsiebenmuslcit$citypop_le10>=700)
citytausendacht<-filter(tachtmuslcit, tachtmuslcit$citypop_le10>=500)
citytausendacht
```

```
## # A tibble: 1 x 69
##   indicator city  country  year arab_peninsula latitude longitude
##       <dbl> <chr> <chr>   <dbl>          <dbl>    <dbl>     <dbl>
## 1       598 Cons~ Turkey   1800              0     41.0      29.0
## # ... with 62 more variables: citypop_le10 <dbl>, citypop_le5 <dbl>,
## #   sea <dbl>, river <dbl>, hub_3rr <dbl>, rom_road_nohub <dbl>,
## #   caravan_hub <dbl>, caravan_nohub <dbl>, elevation_m <dbl>,
## #   rugg10 <dbl>, bishop <dbl>, archbishop <dbl>, capital <dbl>,
## #   university <dbl>, muslim <dbl>, me_na <dbl>, muslim_holy_city <dbl>,
## #   plundered <dbl>, soilquality <dbl>, commune <dbl>, ecozones <dbl>,
## #   free_prince_dls <dbl>, total_pop_country <dbl>, dmedina <dbl>,
## #   dmecca <dbl>, drome <dbl>, djerusalem <dbl>, dbyzantium <dbl>,
## #   d_nearest_muslim <dbl>, d_nearest_christian <dbl>, fup <dbl>,
## #   musfup <dbl>, chrfup <dbl>, musfup_devries <dbl>,
## #   chrfup_devries <dbl>, distance_nearest_muslim_le10 <dbl>,
## #   distance_nearest_christian_le101 <dbl>, nrcities_le10_0_20 <dbl>,
## #   citypop_le10_0_20 <dbl>, nrcities_le10_20_50 <dbl>,
## #   citypop_le10_20_50 <dbl>, nrcities_le10_50_100 <dbl>,
## #   citypop_le10_50_100 <dbl>, size_nearest_le10_mus <dbl>,
## #   size_nearest_le10_chr <dbl>, nrcities_le10_0_20_mus <dbl>,
## #   citypop_le10_0_20_mus <dbl>, nrcities_le10_0_20_chr <dbl>,
## #   citypop_le10_0_20_chr <dbl>, nrcities_le10_20_50_mus <dbl>,
## #   citypop_le10_20_50_mus <dbl>, nrcities_le10_20_50_chr <dbl>,
## #   citypop_le10_20_50_chr <dbl>, nrcities_le10_50_100_mus <dbl>,
## #   citypop_le10_50_100_mus <dbl>, nrcities_le10_50_100_chr <dbl>,
## #   citypop_le10_50_100_chr <dbl>, parl_act <dbl>, madrassa01 <dbl>,
## #   D_largestate <dbl>, GranadaEmirate <dbl>, ottoman <dbl>
```