

The R Workshop Book

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Preface

💡 Learn R live!

Prefer to learn via **live instruction**? Register for my [Introduction to R for Data Analysis](#) seminar via Instats on January 15-16 2025.

Welcome to *The R Workshop* Book by [Rebecca L Barter](#).

This book was designed as a companion to two R workshops that I originally developed and taught at the University of Utah: “Introduction to R for Data Analysis”, which I teach over 2 days, and “Advanced R for Data Analysis”, which is just a 1 day workshop. So far, this book only contains the content for the first workshop, but keep an eye on this space as I’ll be progressively releasing the advanced R workshop chapters.

This book, like the original workshops on which it is based, is designed to get you up and running using R for the analysis of tabular data (i.e., data that comes in a table) using the tidyverse, focusing on data manipulation and data visualization. Rather than teaching you everything there is to know about R, this book just teaches what you need to actually start doing data analysis within the modern “tidyverse” ecosystem.

My approach is a somewhat less fancy approach to teaching R than many of the existing modern R books out there, such as [R for Data Science](#), which starts working with data and creating visualizations up front. These are great books, but I personally prefer to teach beginners in a more linear fashion, which takes a more step-by-step approach, starting with understanding how the programming language works and building up to fancy things like actually working with data. If you’re looking to be inspired, *R for Data Science* is probably a better book for you. But if you’re looking for a resource to give you the building blocks for learning R, starting with the absolute basics, then you’re in the right place.

The R programming language is constantly evolving, and my goal is to keep this book up-to-date as new developments emerge.

Teaching from this book

You are absolutely welcome to teach from this book however you like, but I do request that you provide appropriate attribution.

Learn from me!

Feel free to reach out if you're interested in hiring me to teach custom versions of these workshops.

See [my webpage](#) for information on upcoming live public workshops I'm teaching.

Inspiration attribution

The original inspiration for the first parts of this book came from Software Carpentry, which is where I first encountered the gapminder dataset that is used throughout (however, the materials you will find in this book bear little-to-no resemblance to any of the R Software Carpentry workshops.)

Errors, typos, and contributions

If you notice any errors or typos, feel free to let me know by filing an issue on the book's [GitHub repository](#).

Get in touch

Feel free to email me at rlbarter at gmail dot com if you'd like to get in touch.

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Part I

Getting Started

1 R, RStudio, and Quarto

💡 Learn R live!

Prefer to learn via **live instruction**? Register for my [Introduction to R for Data Analysis](#) seminar via Instats on January 15-16 2025.

1.1 What is R?

R is a “programming language” that once we can speak (write) it, we can use it to tell our computer to do things with our data. Just like learning a real language, learning a programming language involves learning an entirely new vocabulary along with the grammar rules that glues it all together. .

Many of you may be familiar with other software programs, like Excel, SAS, SPSS, STATA, or MATLAB. The main issues with these software programs, is that they are proprietary and they cost money.

R, however, is what is called an “*open source*” programming language. This means that it is completely *free*, and also that anyone can be an R developer. The result is that there are massive diverse communities of people who have come together to contribute to the R programming language, helping turn it into the powerful programming tool that it is today.

1.2 What is RStudio?

The *RStudio* “IDE”, which is the computer application that most people use to write their R code (RStudio is to R code what a Word Doc is to text).

ℹ️ Positron

I should probably note here that Posit, the company behind RStudio, has recently developed a new application or “IDE” called *Positron* that will likely eventually supersede RStudio, but Positron still in “Beta” mode and, for now, my recommendation is to stick with RStudio. Rest assured, I’ll update this page once I feel like Positron is ready for

general use.

1.3 Downloading R and RStudio

If you will be using R “locally” (i.e., on your own computer, rather than in the cloud), then you will need to download R from the CRAN website (<https://cran.rstudio.com/>). While this will download an “R” application in which you can technically write R code, I recommend that you instead write your R code inside a separate desktop application called RStudio. You can download RStudio from the Posit website <https://posit.co/downloads/>.

💡 Updating R and RStudio

Even if you already have R and RStudio on your computer, I recommend that you re-download them to ensure that you have the latest versions.

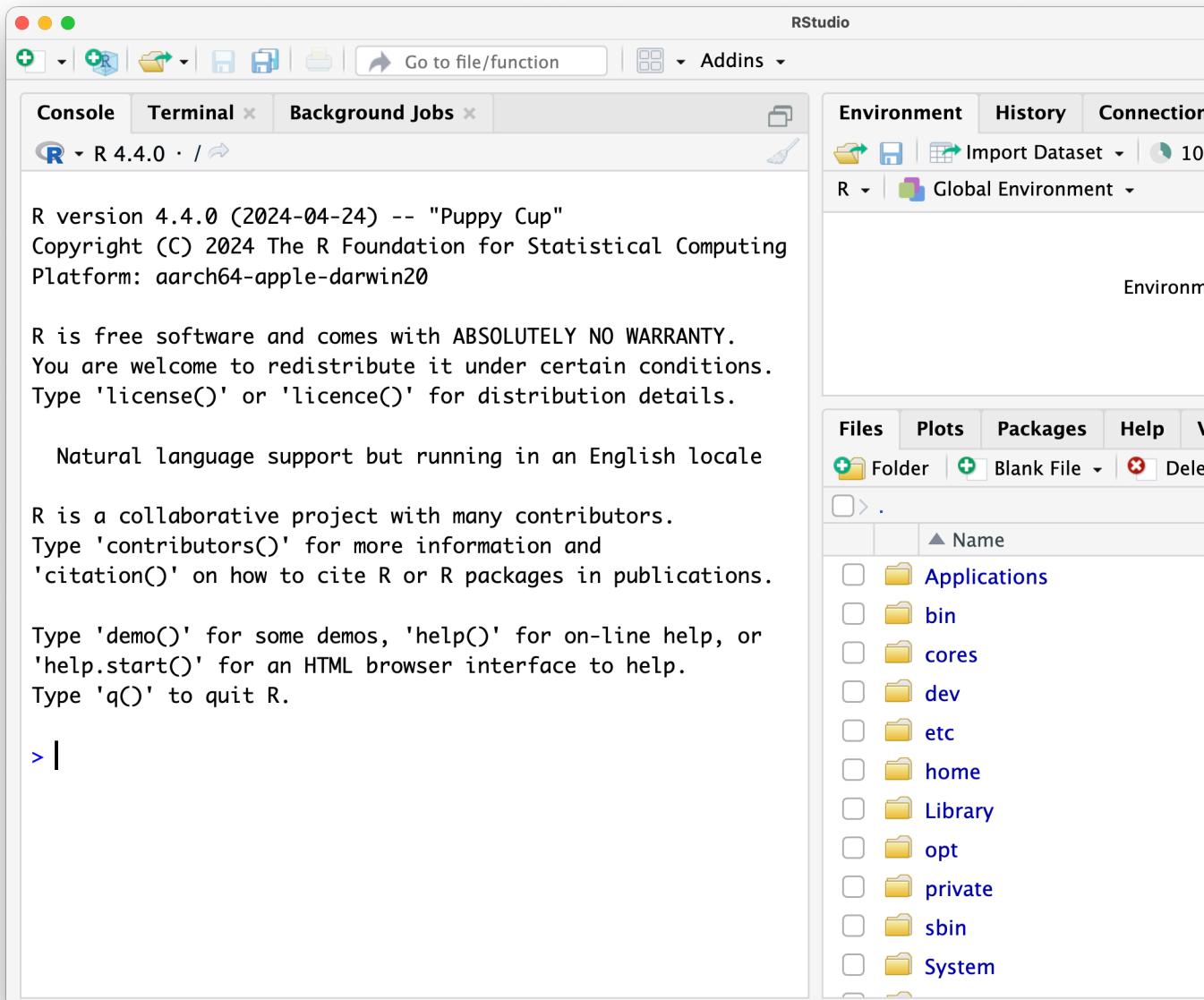
It is good practice to keep up-to-date with the latest versions. In general, I recommend actively re-installing the latest new versions of R and RStudio at least every 6 months or so.

Alternatively, if you prefer not to (or cannot) download applications from the web onto your computer, you can use R and RStudio directly in your web browser with [Posit cloud](#).

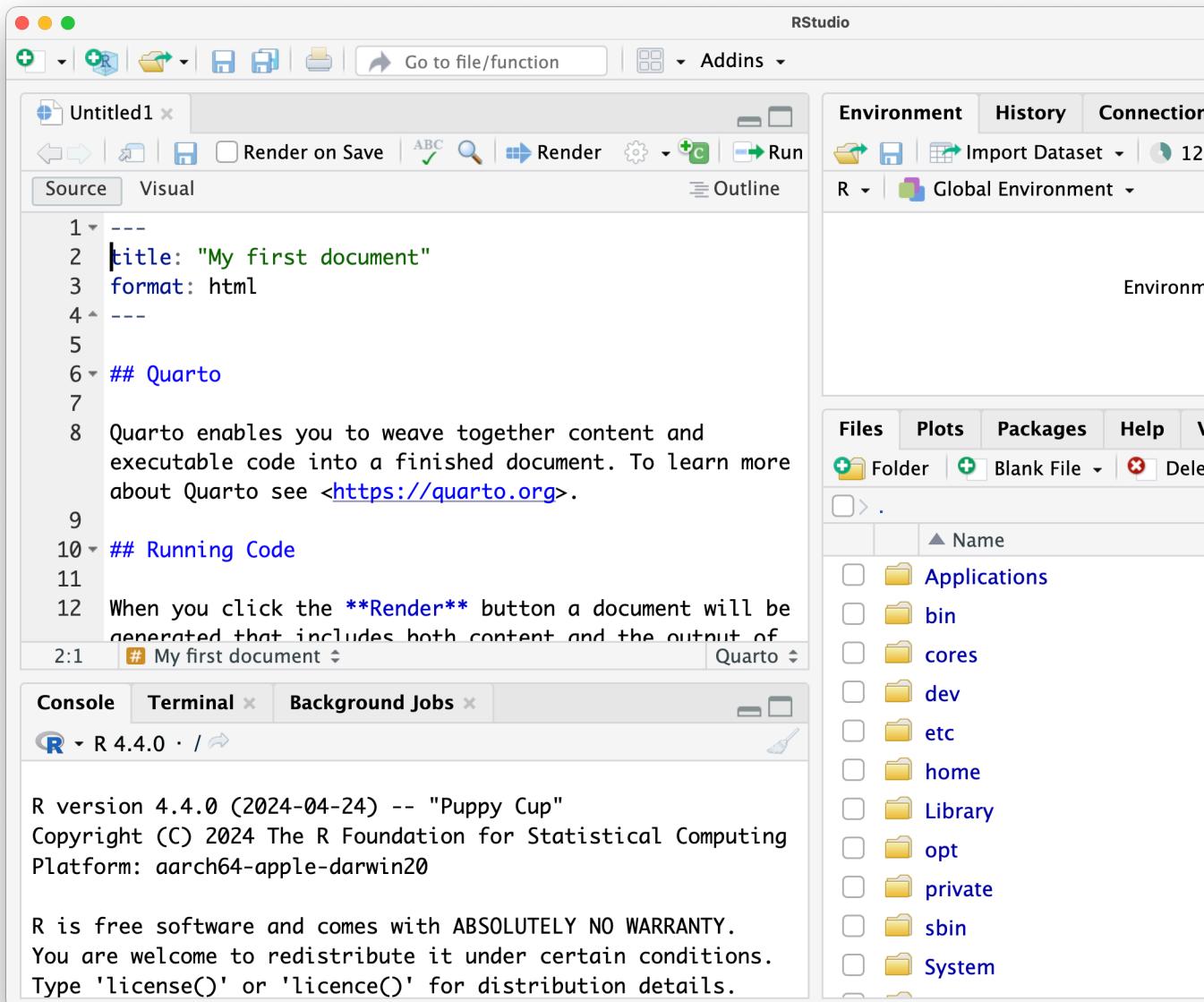
1.4 A tour of RStudio

Since we will be using R inside RStudio, let’s start with a quick tour of RStudio.

Whether you’re using RStudio “locally” on your own computer, or in the cloud, when you open RStudio, it should look something like this:



If you go ahead and select *File > New File > Quarto Document*, type “My first R” in the “Title” bar and your name in the “Author” bar, then your RStudio should look something like this:



Congratulations, you've just created your first R document (the top-left panel that just appeared in your RStudio application)! Technically, this is called a *quarto* document, but you can think of it like a Word document in which you are going to write both regular text and R code text to tell a data-driven story! We will talk about the contents of this document in a moment.

If you've used RStudio before, you might have re-arranged the four panels that you see in the

image above, but your version should have the same general features as in the image above:

- A **document panel** (the top-left panel in the image), which is where the document that you’re currently *writing* in lives.
- A **console panel** (The bottom-left panel in the image), which is where we can *run* the code that we write.
- An **environment panel** (the top-right panel in the image), which will show the “objects” that exist in your R environment. We haven’t run any code yet, so this is empty.
- The **files panel** (which is also the **plot panel** and **viewer panel**), which shows the files in the current local “directory” (the folder on your computer). When you first open RStudio, this is typically your computer’s home page.

Note that the size of each panel can be changed by dragging the border between two adjacent panels.

The most important panels at the moment are the *documents* and *console* panels on the left, so let’s take a closer look at these.

1.5 Quarto documents

The top-left documents panel contains the document that you’re currently working in. There are several types of documents that you could create in which you could write your R code, but I recommend using *quarto documents*.

Quarto versus R Markdown

If you’re already familiar with *R Markdown*, *quarto* is just its modern successor and at first glance, quarto is pretty much the same as R Markdown, with minor syntactic differences. Don’t worry, if you already have a bunch of old R Markdown documents, there isn’t much to be gained by converting them to quarto files, but I’d recommend that any *new* files you create be quarto files rather than R Markdown. If you’ve never heard of R Markdown, feel free to forget I even mentioned it.

Quarto documents allow you to combine text and code, so that rather than having your R code be lonely on its own, your code (and its output) can instead live nestled in between narrative text that describes the analysis that you’re conducting and summarizes the results you obtain.

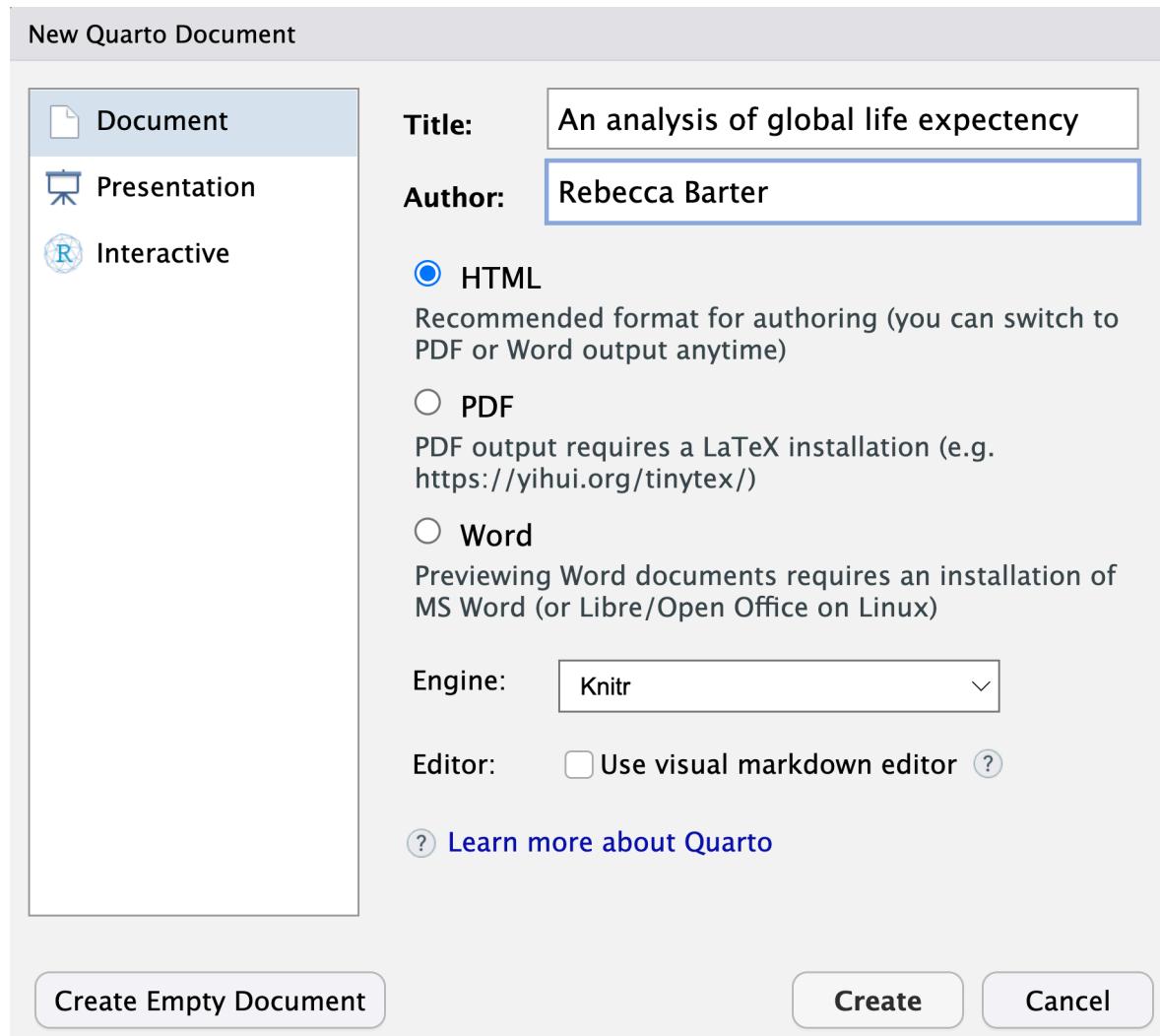
Quarto documents are mind-blowingly versatile, and while they are mostly used to create simple html or pdf documents, they can also be used to make websites (like [mine](#)) and books (like this one!)

Whenever I am conducting an analysis using R, I conduct my analysis in a quarto document. In fact, every chapter in this book is just a quarto document!

Since we want to practice *reproducible* data science, it is important that we keep detailed records of the code we wrote that led us to our data-driven answers. Quarto provides us with an easy way of doing that. Moreover, because you can surround your code with text narrative, it can be used to communicate your analysis and results to other people: quarto lets us feed two birds with one seed!

To start a new quarto document inside RStudio:

- Hit the “New file” icon, , in the top-left-hand corner of RStudio (or *File > New File > Quarto Document*) and select “Quarto document”. The following window should pop up:



Then

- Choose a title (e.g., “An analysis of global life expectancy”), and make yourself the author.
- Hit the “*Create*” button to create your file.

This will open up a new quarto template document in the documents panel.

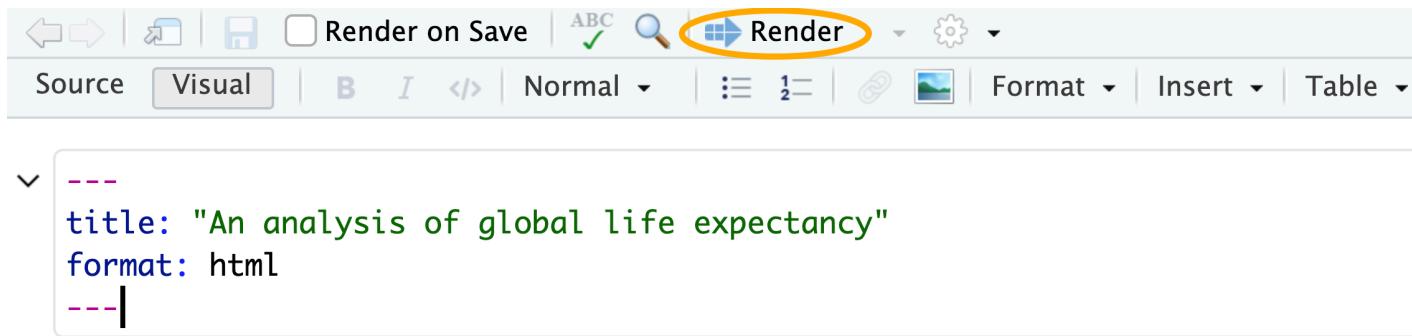
The template text in your new quarto document contains a very summary of how quarto documents work. Take a moment to read it.

The regular white-background text is just text like in a Word Document. The text at the top of the quarto document surrounded by dashes --- is called the **YAML header**, provides several parameters and options for your quarto document, such as the title, the author, and the rendered output format (more on this in a moment).

The grey boxes with {r} are called “code chunks” and these are where we will write your R code.

1.5.1 Rendering quarto documents

Note the instructions in the template quarto document “*When you click the **Render** button a document will be generated that includes both content and the output of embedded code.*” Take the document’s advice: click the “Render” button with a blue arrow, which is circled in orange below and save your document when prompted as “analysis.qmd” or something like that:



Quarto

Quarto enables you to weave together content and executable code into a finished document. Learn more about Quarto see <https://quarto.org>.

Running Code

When you click the **Render** button a document will be generated that includes both the code and the output of embedded code. You can embed code like this:

```
{r}  
1 + 1
```

You can add options to executable code like this

```
{r}  
#| echo: false  
2 * 2
```

The `echo: false` option disables the printing of code (only output is displayed).

(Top Level) ▾

Hopefully, what happened when you hit “Render” is that some text appeared very quickly in your bottom-left “console” panel and your web browser opened up with a new (html) webpage with whatever title you provided that looks something like this:

The screenshot shows a web browser window with a dark theme. The title bar reads "An analysis of global life expect" and the address bar shows "localhost:4364". The main content area displays a Quarto document. The title "An analysis of global life expect" is at the top. Below it is a section titled "Quarto" with a horizontal line underneath. A text block follows, stating: "Quarto enables you to weave together content and executable code in a single document. To learn more about Quarto see <https://quarto.org>". Another section titled "Running Code" is shown with a horizontal line underneath. Below it is a text block: "When you click the **Render** button a document will be generated containing both the document content and the output of embedded code. You can embed R, Python, or Julia code directly into your document." A code block is displayed in a light gray box:

```
1 + 1
```

[1] 2

You can add options to executable code like this

```
[1] 4
```

If you're using RStudio in the cloud (or you have different settings to me), you may have instead found that the window opened in the "Viewer" panel of your RStudio application. If no window opened anywhere, navigate to the location on your computer where you saved your quarto document ("analysis.qmd") and see if a new file "analysis.html" has appeared. If it has, open it in your web browser.

What happened when we hit the "Render" button? Hitting "Render" renders your *interactive* quarto (analysis.qmd) document as a *static* HTML (analysis.html) file. This is like saving your interactive word document file that you can edit as a static pdf file that you cannot edit.

Compare the original quarto (analysis.qmd) document in RStudio with the rendered page (analysis.html) in your web browser. What differences do you notice? Which one can you modify?

💡 Rendering quarto as PDF and Microsoft Word documents

By default, quarto documents will be rendered as HTML files, but they can also be rendered to PDF and Microsoft Word files! You can do this by changing the `format: html` in the "`yaml`" text at the top of your quarto document (right underneath the "title" and "author" definitions) to `format: pdf` or `format: docx`, respectively.

However, note that to render a quarto document to a PDF file, you will need to have an application called LaTeX installed on your computer (see the exercise below).

If you switched to `format: pdf`, we recommend switching back to `format: html` for the rest of this lesson.

1.5.2 "Visual" mode versus "Source" mode

There are currently two modes that your *interactive* quarto document (i.e., the version in RStudio, not the rendered HTML document) can be in.

The "analysis.qmd" file in "visual mode" looks like this:

```
---
```

```
title: "An analysis of global life expectancy"
format: html
```

```
---
```

Quarto

Quarto enables you to weave together content and executable code into a finished document. Learn more about Quarto see <https://quarto.org>.

Running Code

When you click the **Render** button a document will be generated that includes both the output of embedded code. You can embed code like this:

```
{r}
1 + 1
```

You can add options to executable code like this

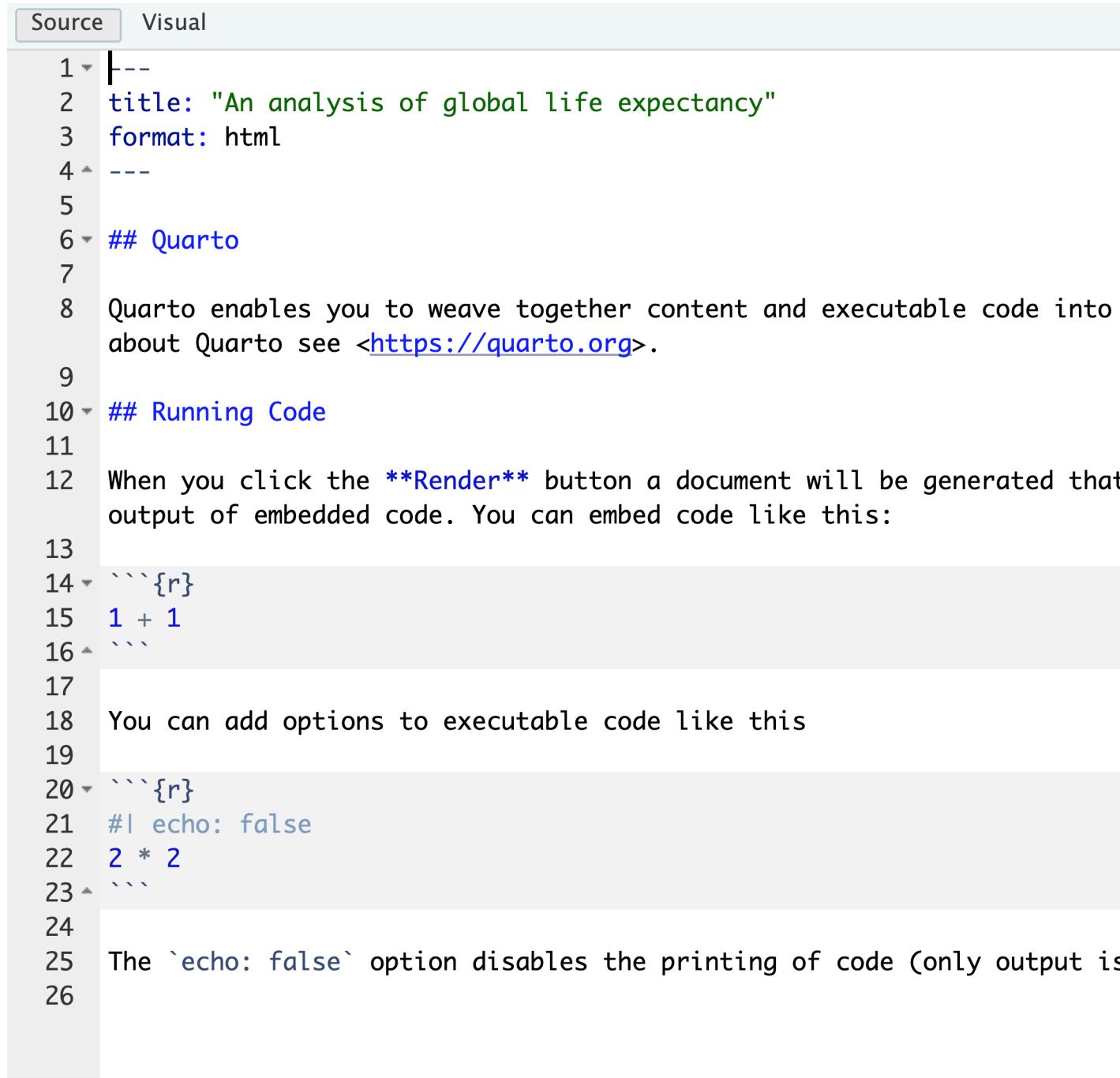
```
{r}
#| echo: false
2 * 2
```

The `echo: false` option disables the printing of code (only output is displayed).

If your quarto document is in visual mode, it will be a lot more like a Word Document, where you will see boldface text, headings, italics, links, etc.

In this visual mode format, much of the underlying quarto syntax is hidden from you.

Alternatively, if you view this same “analysis.qmd” quarto document in “Source” mode, you will be looking at the underlying quarto (markdown) syntax. The “analysis.qmd” file in source mode looks like this:



The screenshot shows a code editor window with two tabs: "Source" (selected) and "Visual". The "Source" tab displays the following Quarto code:

```
1 ---  
2 title: "An analysis of global life expectancy"  
3 format: html  
4 ---  
5  
6 ## Quarto  
7  
8 Quarto enables you to weave together content and executable code into  
about Quarto see <https://quarto.org>.  
9  
10 ## Running Code  
11  
12 When you click the **Render** button a document will be generated that  
output of embedded code. You can embed code like this:  
13  
14 ```{r}  
15 1 + 1  
16 ````  
17  
18 You can add options to executable code like this  
19  
20 ```{r}  
21 #| echo: false  
22 2 * 2  
23 ````  
24  
25 The `echo: false` option disables the printing of code (only output is  
26
```

Notice that there is no boldface text, or headings, etc. Instead there are raw text symbols to

represent these things. For instance, surrounding text by two asterisks (**) creates boldface text and preceding some text with pound symbols (##) creates headings (the more pound symbols used, the more lower-level the heading). This text syntax is called “Markdown” syntax.

Can you identify whether your quarto document is currently in source or visual mode?

You can toggle your quarto document between source and visual mode using the “Source” and “Visual” buttons in the top-left corner of your quarto document in RStudio.

Whether you prefer source or visual mode will come down to a personal preference. I personally prefer working with the source mode where I can see the underlying Markdown syntax that defines the text formatting and R code chunks, but I know many people who prefer the visual mode.

1.5.2.1 Markdown syntax

In case you’re interested in learning a little bit more about Markdown syntax, switch your document over to the “Source” mode by hitting “Source” in the top left corner of your document.

Re-render your document by hitting the “Render” button, and based on the rendered static html page that will open in your web browser, let’s try to make some sense of the Markdown syntax used in the original quarto (.qmd) document in RStudio.

Can you see what the ## syntax is doing (if you can’t see the ## syntax in your quarto document in RStudio, ensure that you are viewing the quarto document using “Source” rather than “Visual” in the top-right corner of the document)? The pound symbols are **markdown** syntax for creating headers: # will create a top-level header (this is the same level as the overall document title), ## will create a level-2 header, ### will create a level-3 header, etc.

Notice that the word “**Render**” is shown in bold in the rendered html file. By looking at the .qmd file, can you figure out what the markdown syntax is for creating bold-face text?

To learn more about markdown syntax, see <https://www.markdownguide.org/basic-syntax/>.

If you want to play around with the Markdown formatting syntax, add some additional markdown features to your `analysis.qmd` file (E.g., a sub-section heading, some italics, or extra bold text), and re-render your quarto html output by hitting the “Render” button. Take note of how the changes you made were rendered in the static HTML version of your document.

1.6 Where to write your code

1.6.1 Writing R code in code chunks in a quarto document

I recommend that you write 99% of your R code in a quarto document, specifically, your R code should live in the grey boxes with `{r}`—these are called “**code chunks**”.

Hopefully when you were comparing your interactive quarto document with the rendered HTML document, one difference that you noticed that the rendered document also showed the “output” of the two R code chunks, which contained the R code `1 + 1` and `2 + 2` (the *output* of these two code chunks were 2 and 4, respectively.)

The image below shows how this interactive code chunk looks in the quarto document (in source mode):

```
```{r}
1 + 1
```
```

Which you can compare with the following image that shows how the static code chunk looks in the rendered HTML document:

```
1 + 1
```

```
[1] 2
```

When a quarto document is rendered into a HTML document, the code in each of the code chunks is compiled and the result or “output” (in this case the result is 2) is printed underneath the chunk.

You can provide “options” to code chunks, which are specified with a point symbol followed by a vertical bar on the first line(s) of the quarto chunk `#|`, such as `#| echo: false`, which will tell quarto that it should hide the R code, but still show the output. So if I have this in my interactive quarto document in RStudio:

```
```{r}
#| echo: false
1 + 1
```
```

I will only see this in the rendered HTML document (i.e., the `1 + 1` code is hidden):

```
[1] 2
```

1.6.2 Writing and running R code in the console

Admittedly, it would be really annoying if every time you wanted to see the output of your code, you had to render the entire quarto document and look at the output in the HTML document. No one has that much patience.

Fortunately, you can check the output of your code by running it in the console panel, which is usually directly underneath your quarto document.

Console

Terminal

Background Jobs



R 4.2.2 · ~/

```
R version 4.2.2 (2022-10-31) -- "Innocent and Trusting"  
Copyright (C) 2022 The R Foundation for Statistical Computing  
Platform: aarch64-apple-darwin20 (64-bit)
```

```
R is free software and comes with ABSOLUTELY NO WARRANTY.  
You are welcome to redistribute it under certain conditions.  
Type 'license()' or 'licence()' for distribution details.
```

Natural language support but running in an English locale

```
R is a collaborative project with many contributors.  
Type 'contributors()' for more information and  
'citation()' on how to cite R or R packages in publications.
```

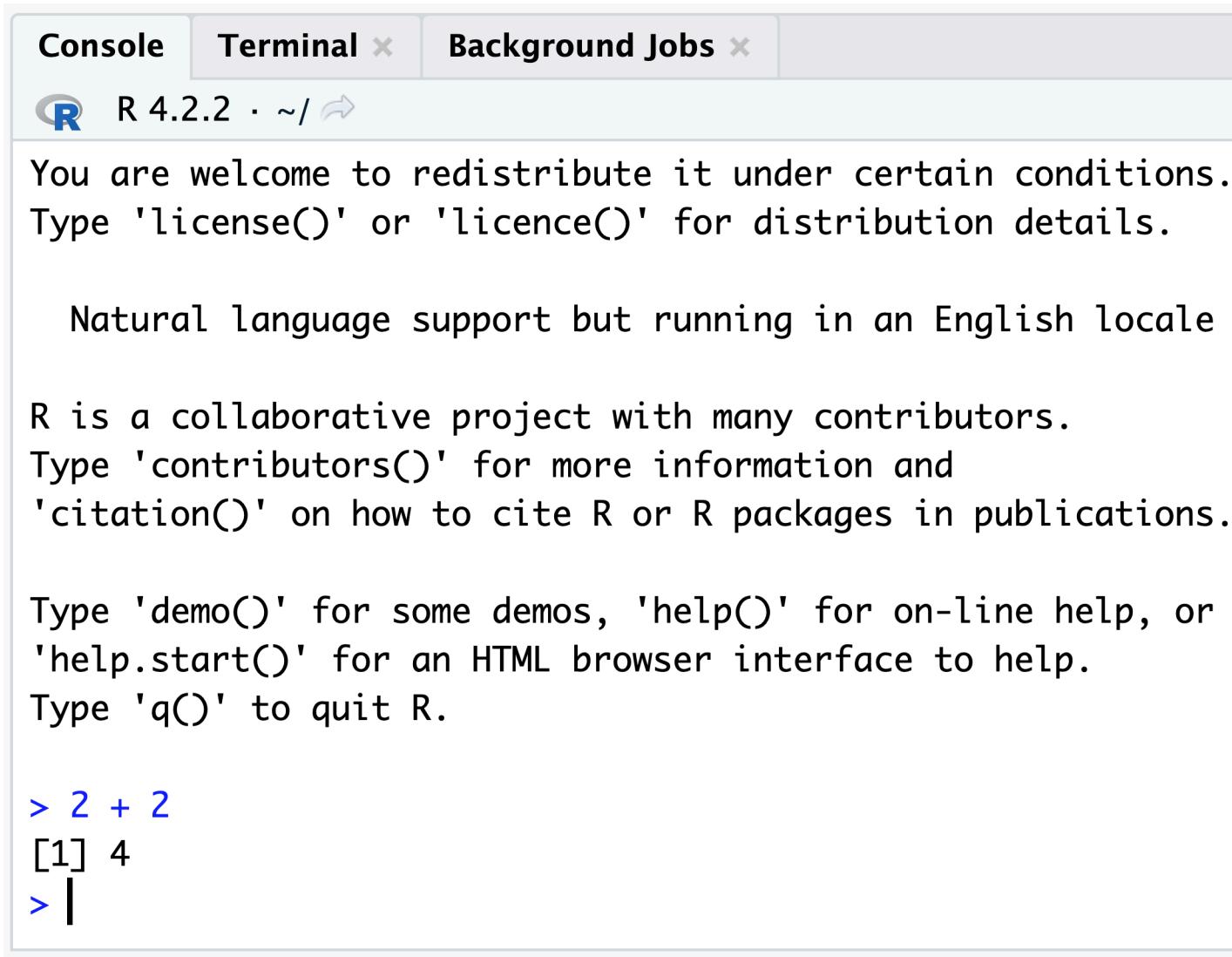
```
Type 'demo()' for some demos, 'help()' for on-line help, or  
'help.start()' for an HTML browser interface to help.  
Type 'q()' to quit R.
```

> |

If you click on the console panel (and scroll down to the bottom), you should see an arrow > with a blinking cursor | symbol. This means that the console is waiting for you to type your code.

In your console in RStudio, after the > symbol, type 2 + 2 and then hit return (Enter).

Your console should have produced the output/result of your code (4) underneath, and a new arrow > with a blinking cursor should have appeared underneath, indicating that R is ready for some more code like this:



```
Console Terminal × Background Jobs ×
R 4.2.2 · ~/ ↵
You are welcome to redistribute it under certain conditions.
Type 'license()' or 'licence()' for distribution details.

Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type 'contributors()' for more information and
'citation()' on how to cite R or R packages in publications.

Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> 2 + 2
[1] 4
> |
```

So if you can just write your code directly in the console, why bother with the quarto document at all?

The problem with only ever writing your R code in the R console is that once you quit RStudio, there will be no record of the code that you ran.

1.6.3 Best practices: quarto vs the console

Best practices for writing and saving R code involves writing your code in R chunks within a quarto document, and then running that code in the console (and then later rendering your quarto document after you've written a bunch of code).

This might sound convoluted, but fortunately, you don't have to write your code in two places. Once you write some code in a code chunk in your quarto document, you will notice a green "play" (right arrow) button at the right end of the code chunk. If you hit that, you will see one of two things happen:

1. **Chunk output inline:** The output of your code will appear directly underneath your code chunk *inside* your interactive quarto document.

The screenshot shows the RStudio interface with the following details:

- File Menu:** File, Open, Save, Print, Go to file/function, Addins.
- Toolbar:** Untitled1, Render on Save, ABC, Render, Run.
- Source Tab:** Shows R code:

```
12 When you click the **Render** button a document will be generated that
13 includes both content and the output of embedded code. You can embed code
14 like this:
15 `r
16 1 + 1
17
18 You can add options to executable code like this
19
20 `r
21
```
- Console Tab:** Shows the output of the code execution:

```
[1] 2
```

The output line "[1] 2" is circled in red, and an arrow points from the text "16" in the code to this circled output.
- Status Bar:** Copilot: No completions available. Quarto.
- Environment Tab:** Shows the file system structure.

2. **Chunk output in console:** Your code be magically transported to the console, where it will be automatically run and the output will be shown *in the console*.

The screenshot shows the RStudio interface. In the top-left, there's a code editor window titled "Untitled1*" containing R code. The code includes comments explaining the Render button and how to embed code. Below the code editor is a console window showing the result of running the code `1 + 1` which outputs `2`. A red circle highlights the settings button in the console toolbar, and a red arrow points from the explanatory text in the code editor to this highlighted button.

```
12 ## Running Code
13
14 When you click the **Render** button a document will be generated that
includes both content and the output of embedded code. You can embed code
like this:
15
16 ``{r}
17 1 + 1
18 ```
19
20 You can add options to executable code like this
21
22 ``{r}
23 #| echo: false
24 ````
```

18:1 Chunk 1 Copilot: Waiting for completions... Quarto

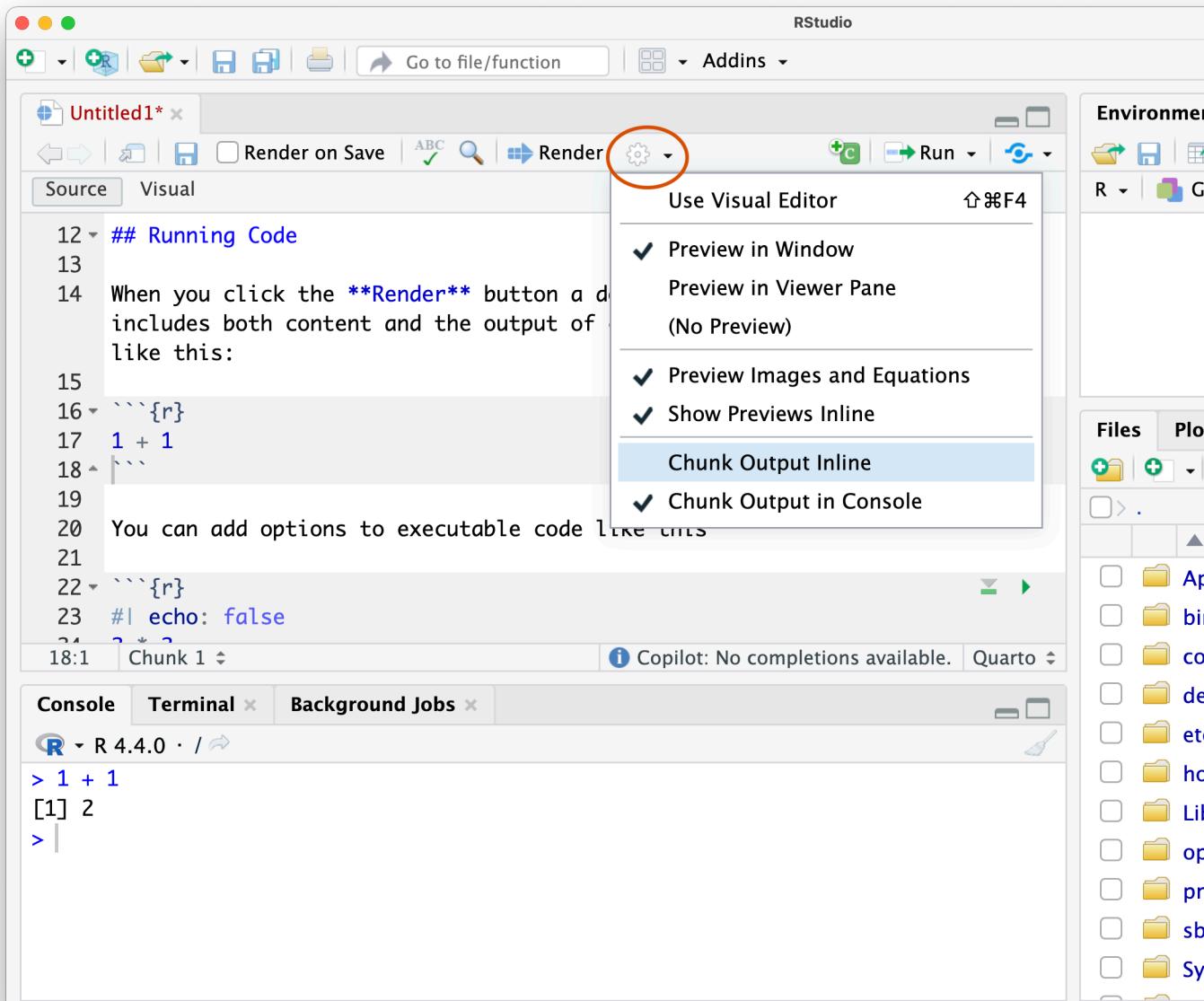
Console Terminal Background Jobs

R 4.4.0 /

> 1 + 1
[1] 2
>

There is also a nice keyboard shortcut for running the line of code on which your cursor is: **Command+Enter** on a Mac or **Ctrl+Enter** on Windows and Linux.

You can change the settings for where your output appears by selecting the settings button (circled in the image below) and choosing “Chunk output inline” for the first option or “chunk output in console” for the second option.



I strongly prefer the second option of “chunk output in console”, but R users are notoriously divided on where they like their output to appear (inline or in the console).

My suggestion is try both options for a few hours and see which one sparks joy.

Regardless of where your output appears (inline or in the console), I strongly suggest that you write all your code in a quarto document (rather than directly in the console). Writing your

code in a quarto document will save your code and results in a *reproducible* way AND let you create a document that you can use to communicate your findings to other people.

1.6.4 Creating new code chunks in quarto

In a quarto document you can open a new R code chunk by writing three backticks followed by the letter “r” inside some curly parentheses and you need to “close” the code chunk with three backticks. Anything between these two lines (inside the grey box) is treated as R code, and anything outside these two lines is regular text.

```
```{r}  
~~~
```

Since it’s a pain to type all that every time you want to create a new code chunk, you can use one of two shortcuts to create a new code chunk:

1. Hit the “New Chunk” button, in RStudio, or
2. Use the Option+Command+i keyboard shortcut.

Give it a go yourself: In your quarto document, create three new code chunks, one in each of the three ways described above. Conduct some basic mathematical calculations in each code chunk and run the code using any of the approaches described in the previous section (your output should appear either inline or in the console, depending on the settings). Then render your quarto document and look at the html output.

Next, add a chunk option to hide the code `#| echo: false` to one of your chunks (this `echo: false` chunk option must go on the first line of the chunk) and re-run your code (nothing should be different) and re-render your document and look at the output. What has changed?

⚠ Common issue: I can’t find my rendered document

If you can’t find your rendered HTML document, find the location where you saved your quarto document and find the `.html` file with the same name. Open this file in your web browser – this is your rendered document. If it doesn’t update, when you render your quarto document, there might be an error in your quarto document (check the “Background Jobs” tab in the console panel to see if there are any error messages).

 Common issue: I can't run my code

R is very particular about the syntax for the code chunks. There must be no spaces in front of the backticks that define the code chunk and your chunk options that start with `#|` must be on the first line of the code chunk directly under the backticks and not have any spaces before it.

If your code shortcuts don't work, start super hard at your code chunk and see if there is anything wrong!

## **Part II**

# **R Fundamentals**

## 2 R Fundamentals

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### 2.1 Doing math with R

Who needs a calculator, when you have R! I legitimately use R as a basic calculator all the time. And while R can do a lot more than just compute  $1 + 1$ , it's worth taking a moment to discuss basic mathematical operations of R.

Here are some helpful math symbols in R:

- Parentheses: `(, )`
- Exponents: `^` or `**`
- Multiply: `*`
- Divide: `/`
- Add: `+`
- Subtract: `-`

To follow along with the code examples that I provide in this chapter (and in this book in general), I recommend creating a new quarto document and practicing writing your own code in code chunks in your quarto document and running the code in the *console* by either pressing the green play/arrow button in the top right corner of the code chunks or using the Command+Return shortcut. Feel free to make some of your own notes in your quarto document outside. I recommend compiling/rendering your quarto document every now and then too!

Some basic mathematical computations you can compute in R include power calculations:

```
(3 + 5)^2
```

```
[1] 64
```

Division:

```
2 / 7
```

```
[1] 0.2857143
```

Note that R doesn't really care about spaces, so this is the same as

```
2/7
```

```
[1] 0.2857143
```

But my recommendation is to always place a single space around mathematical operators (i.e., \*, +, -, etc, with the exception of the power operator  $\wedge$ ), so:

```
2 + 1
```

```
[1] 3
```

```
5 * 3
```

```
[1] 15
```

```
5^2
```

```
[1] 25
```

When writing code, even if the language itself doesn't require certain syntax like spaces, it is a good idea to choose a syntax *style* and stick with it.

You can place multiple computations in the same code chunk, like this:

```
```{r}
5 + 109
(4 + 2) * 4
```
```

When a code chunk contains multiple pieces of code, they will all be computed separately when you compile your document and the output will look like this:

```
5 + 109
```

```
[1] 114
```

```
(4 + 2) * 4
```

```
[1] 24
```

## 2.2 Code comments

When you have multiple pieces of code in a single code chunk (or even a single piece of code), it is recommended that you use code comments to explain what your code is doing. Since R treats everything inside a code chunk as code, if you want to write some text comments inside a code chunk, you can tell R that your text is not code by placing a `#` symbol at the beginning of your text like this:

```
# compute 4 times 5  
4 * 5
```

```
[1] 20
```

R will ignore anything that follows a `#` symbol. So in the above code chunk, R will ignore the first line with the code comment “compute 4 times 5”, and then it will compute the R code on the next line, `4 * 5`.

Code comments are really helpful for explaining what your code is doing. I usually reserve the text *outside* code chunks for more general discussion of my data, analysis, and results and I reserve code comments *inside* code chunks for explaining my code itself. Since I tend to forget the reasons behind certain decisions I made in my code, adding explanations in code comments helps me remember my motivations and intentions days, months, or even years later.

## 2.3 Scientific notation

When doing mathematical calculations in R, very quickly you are going to start encountering some very strange-looking output. For example, if I compute

```
1 / 70000
```

```
[1] 1.428571e-05
```

or

```
12^15
```

```
[1] 1.540702e+16
```

You can see that my output looks a little strange.

When a number is very big or very small, R gets lazy and decides that it doesn't want to print all of its digits. Rather than just making up random numbers, R is printing these numbers in scientific notation.  $2\text{e}-05$  means "0.00002", i.e., there is a 2 in the 5th decimal place. On the other hand,  $2\text{e}+05$  (with a + instead of -), corresponds to 200000, i.e., "2" with 5 0's after it.

💡 No commas allowed!

Note that R doesn't allow for commas in numbers. If you want to write a large number, you have to remove the comma:

```
# this is fine  
70000
```

```
[1] 70000
```

```
# this is not fine -- note the "error" message  
70,000
```

```
Error: <text>:1:3: unexpected ',',  
1: 70,  
          ^
```

## 2.4 Mathematical functions

While being able to do addition, subtraction, and multiplication is super awesome, sometimes you will need to use more complex mathematical operations in your computations, such as the

logarithm, exponential, and square root. Fortunately, there are **functions** in R that let you compute these operations.

A function is a piece of R code that is referenced using an alias or a name. A function typically takes an “argument”, such as a number, and it does something to the argument, such as compute the logarithm, and then it returns the result.

To apply a function to a value, you write the name of the function (e.g., `log`), followed by some parentheses `()`, inside which you provide the argument or value that you want to apply the function to, as in: `log(2)`.

```
# compute the square root of 2
sqrt(2)
```

```
[1] 1.414214
```

```
# compute the log of 2
log(2)
```

```
[1] 0.6931472
```

```
# compute e^2
exp(2)
```

```
[1] 7.389056
```

## 2.5 Defining variables

One of the main features of coding in R is defining “objects” or “variables” (I use these terms interchangeably). Creating a variable essentially involves giving a value a name, allowing you to reference that value later. When we are ready to load some actual data, we will give that data a name by storing it in a variable.

Let’s store the value `1` in a variable called `my_variable` using the **assignment operator**: `my_variable <- 1`. Think of the assignment operator `<-` as an arrow, pointing from the value on the right to the variable name on the left.

```
my_variable <- 1
```

Note that when you define a variable, no output is shown.

You can view the value of `my_variable` by writing its name:

```
my_variable
```

```
[1] 1
```

You can think of `my_variable` as an alias for the value 1. This means that anything that I could do to the value 1, I can now do to `my_variable`, such as adding 2 to it:

```
my_variable + 2
```

```
[1] 3
```

#### 💡 R is case-sensitive

R is case-sensitive, which means that I must write my variable name exactly as it is written. For example, the following will yield an error:

```
my_Variable
```

```
Error in eval(expr, envir, enclos): object 'my_Variable' not found
```

because the variable is called `my_variable`, not `my_Variable`.

#### 💡 Defining variables using =

Another way to define a variable is using “=”.

Below, I create `another_variable`, assign it the value 3

```
another_variable = 3  
another_variable
```

```
[1] 3
```

However, convention in the R community prefers the use of the `<-` assignment operator over the `=` assignment operator. So while `=` will work just fine, it is less common among seasoned R programmers.

Whenever we do a mathematical calculation using numeric values, we create a new numeric value, for example, the computation

```
1 + 1
```

```
[1] 2
```

creates the value 2.

You can also assign the *output* of a mathematical calculation to a variable.

```
# assign the output of 1 + 1 to the variable one_plus_one
one_plus_one <- 1 + 1
one_plus_one
```

```
[1] 2
```

It is important to make the distinction that `one_plus_one` does not contain the mathematical *equation*  $1 + 1$ . Instead, it contains the numerical value, 2, which is the *output* of the equation  $1 + 1$ .

`one_plus_one` doesn't remember that it was created by computing  $1 + 1$ , it just knows that the value it contains is 2.

## 2.6 Exercise

Define a new object `prod` that contains the output of the product of 5 and 2. Print out `prod` by writing its name

## 2.7 Solution

```
prod <- 5 * 2
prod
```

```
[1] 10
```

### 2.7.1 Overwriting variables

Below I define `my_number` to be a variable containing the numeric value 5.

```
my_number <- 5
```

Next, I define a new variable called `result` that contains the product of `my_number` and 7 and I print it out:

```
result <- my_number * 7  
result
```

```
[1] 35
```

Here, `result` is defined based on the value of `my_number`.

What do you think would happen to `result` if I redefine `my_number` to now contain 8?

```
# update the value of my_number to be 8  
my_number <- 8
```

Do you think `result` will have changed? Try it yourself in RStudio or click the “Answer” tab below.

## 2.8 Question

What happens to `result`?

## 2.9 Answer

```
# define result using `my_number`  
result <- my_number * 7  
result
```

```
[1] 56
```

```
# modify my_number  
my_number <- 8
```

Result does not change.

```
result
```

```
[1] 56
```

When we defined `result <- my_number * 7`, we assigned `result` to the *output* of `my_number * 7`, which is 56.

Once it has been defined, `result` forgets all about `my_number`, it just remembers the value 56.

This means that changing `my_number` *after* having defined `result` will have no effect on `result`. There is no link between the two variables, even though `result` was originally defined using `my_number`!

## 2.10 Exercise

Without running the code below, guess what the output/result will be:

```
value <- 1
computed_result <- value * 10 + 3^2
value <- value + 2
computed_result
```

## 2.11 Solution

Note that the first three lines of code all involve defining variables and so no output is shown when these are run. The final line of code will print out the value of `computed_result`.

The second line `computed_result <- value * 10 + 3^2` defines `computed_result` using `value`. Then the third line `value <- value + 2` updates `value`. Since `computed_result` is assigned to the *output* of `value * 10 + 3^2`, which is 19, it doesn't care when `value` is subsequently updated, and so the `computed_result` is still just equal to 19:

```
value <- 1
computed_result <- value * 10 + 3^2
value <- value + 2
computed_result
```

```
[1] 19
```

### 2.11.1 Variable names

While you can give your variables *almost* any name you like, there are a few rules that you need to follow.

While variable names can contain letters, numbers, underscores, and periods, the recommended convention specifies that variable names should contain purely **lowercase letters and numbers, with words separated by underscores**.

For example, `var_name` and `my_var` are considered “good” variable names, whereas `varName`, `VarName`, and `var.name` are not.

Note that variable names cannot *begin* with numbers or underscores. If you try to create variables whose names are illegal, you will get an error, such as:

```
1plus1 <- 1 + 1
```

```
Error: <text>:1:2: unexpected symbol
1: 1plus1
^
```

```
_var <- 1 + 1
```

```
Error: <text>:1:2: unexpected symbol
1: _var
^
```

## 2.12 Exercise

Which of the following are valid R variable names? Which ones are *good* variable names?

```
min_height
max.height
_age
MaxLength
min-length
2widths
```

## 2.13 Solution

- `min_height`: this is a **good** variable name
- `max.height`: this is a **valid** variable name, but not necessarily a “good” variable name (words should be separated with `_`, not `.`)
- `_age`: this is **not a valid** variable name (variable names cannot start with `_`)
- `MaxLength`: this is a **valid** variable name, but not necessarily a “good” variable name (words should be lowercase and separated with underscores)
- `min-length`: this is **not a valid** variable name (words should be separated with `_`, not the minus sign `-`)
- `2widths`: this is **not a valid** variable name (variable names cannot start with numbers)

# 3 Types

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## 3.1 Common object types

So far, we have only worked with numbers in R. But there are many other kinds of values that you will encounter in your R journeys.

The main types of values that you'll encounter in R are:

- **Numeric**: numbers, e.g., 1, 3.5, 1e5 (which is scientific notation for 100,000)
- **Character**: free-form text values, e.g., "California", "John Doe", "XJ1784"
- **Logical** (Boolean): binary values corresponding to TRUE and FALSE

### 3.1.1 Numeric values

You can use the `class()` function to ask what type of object a value is. For example, the class of `9.6` is “numeric”

```
class(9.6)
```

```
[1] "numeric"
```

So is the class of `-5`

```
class(-5)
```

```
[1] "numeric"
```

and `1e7` (which is scientific notation for 10,000,000)

```
class(1e7)
```

```
[1] "numeric"
```

You can also use the `class()` function to ask the class of the value stored in a *variable*:

```
y <- 2 * 3 + 1  
y
```

```
[1] 7
```

Identify the class of `y` (which contains the value 7):

```
class(y)
```

```
[1] "numeric"
```

If your object has class "numeric", you can do mathematical computations with it:

```
y + 2
```

```
[1] 9
```

```
y^3
```

```
[1] 343
```

## 3.2 Exercise

Identify the class (type) of the value `99.9`

## 3.3 Solution

```
class(99.9)
```

```
[1] "numeric"
```

### 3.3.1 Character values

Many datasets will contain text as well as numbers! In R, text has a “character” type.

The following contain examples of character type values:

```
"banana"
```

```
[1] "banana"
```

```
"I really like owls"
```

```
[1] "I really like owls"
```

And like numbers, you can save character type values in a variable:

```
char_var <- "my first character variable"
```

To view the contents of our character variable, you just type its name as usual:

```
char_var
```

```
[1] "my first character variable"
```

And I can ask what class it has using the class function:

```
class(char_var)
```

```
[1] "character"
```

What is the difference between a variable name and a character value? **Character values are always surrounded by quotes**, whereas variable names are not.

So if I try to type `banana` into my R console without the quotes, R will think I am referring to a variable name called `banana` and I will get a mildly rude error because I haven’t defined any variables called `banana`:

```
banana
```

```
Error in eval(expr, envir, enclos): object 'banana' not found
```

The `object 'banana' not found` means that I've accidentally referred to a variable in my code (`banana`, in this case) that doesn't exist because I haven't defined it!

## 3.4 Question

What will be the class of the following variable that contains the value "1" with quotes (as opposed to 1 without quotes)?

```
var_one <- "1"
```

## 3.5 Solution

It's a character value

```
class(var_one)
```

```
[1] "character"
```

Note the quotes when I print out the variable:

```
var_one
```

```
[1] "1"
```

Does the answer to the question above surprise you? Remember, that whenever a value is surrounded by quotes, it is a character. It doesn't matter whether the value contains a number or not!

### 3.5.0.1 Mathematical computations with character values

What do you think will happen when you try to do mathematical operations with character (text) variables?

Let's define a character variable and try to add the number 1 to it:

```
# define a character variable
char <- "hello"
# try to add 1 to it
char + 1
```

```
Error in char + 1: non-numeric argument to binary operator
```

This `Error in char + 1 : non-numeric argument to binary operator` error will become very familiar to you in time. This error is a very unhelpful way that R tells us that we *cannot do mathematical operations with non-numeric (e.g., character) values*. Bummer.

So if we can't do math with character values, what's the point of them?

The purpose of character values is to store categorical and text information, which we will often use to do things like creating groups in our data (e.g., separating people according to the state in which they live).

### 3.5.1 Logical values

Next up are the “logical” (“Boolean”) type values. These are fairly simple because there are only two of them: TRUE and FALSE.

```
TRUE
```

```
[1] TRUE
```

```
FALSE
```

```
[1] FALSE
```

For your logical value to be recognized as a logical value it must be in all caps. As if you're yelling (LIKE THIS). If you don't yell loud enough, R will complain. For instance, if I only yell the first letter, like this:

```
True
```

```
Error in eval(expr, envir, enclos): object 'True' not found
```

R says `Error: object 'True' not found`, which, if you were paying attention earlier, is code for “there is no *variable* named True. R is trying to find a variable called `True` and it’s failing to do so which is unsurprising... because you haven’t defined one! It doesn’t know you’re trying to use a logical `TRUE` value, because you didn’t use all caps.

As with everything else, we can use `class()` to ask the class of logical values, and unsurprisingly, it tells us that the class of logical values are “logical”:

```
class(TRUE)
```

```
[1] "logical"
```

```
class(FALSE)
```

```
[1] "logical"
```

```
logical_var <- TRUE  
class(logical_var)
```

```
[1] "logical"
```

### 3.5.1.1 Mathematical computations with logical values

What do you think will happen when we try to do mathematical operations with logical values? Let’s try:

```
# Try to subtract 3 from logical_var  
logical_var - 3
```

```
[1] -2
```

```
# Try to add 0.2 to FALSE  
FALSE + 0.2
```

```
[1] 0.2
```

Interestingly, it seems to work (unlike when we tried to do mathematical operations with character values)... But what is it doing?

If you could choose any numbers to convert TRUE and FALSE to, what would you choose? I would probably choose TRUE to be 1 and FALSE to be 0. Fortunately for me, this is exactly what R does.

When they are involved in mathematical operations, logical values are converted to their numeric binary counterpart values of 0 (FALSE) and 1 (TRUE).

If you replaced `logical_var` (which contains TRUE) with 1 and FALSE with 0 in the code chunk above, does the output make sense now?

## 3.6 Exercise

Before you run the following code, predict which of the following four computations will work and what their output will be.

```
"TRUE" * 4  
"banana" + "apple"  
FALSE + 5  
TRUE + "TRUE"
```

## 3.7 Solution

Only the third computation is valid.

The first computation doesn't work because "TRUE" is a character type (since it is surrounded by quotes) and you can't add characters and numbers.

```
"TRUE" * 4
```

```
Error in "TRUE" * 4: non-numeric argument to binary operator
```

The second computation doesn't work because you can't add character values to one another.

```
"banana" + "apple"
```

```
Error in "banana" + "apple": non-numeric argument to binary operator
```

This third computation does work because when used in a mathematical operation, the Boolean/logical value FALSE is treated as 0

```
FALSE + 5
```

```
[1] 5
```

The fourth computation doesn't work because "TRUE" is a character type (since it is surrounded by quotes) and you can't add characters to anything, including logical values.

```
TRUE + "TRUE"
```

```
Error in TRUE + "TRUE": non-numeric argument to binary operator
```

## 3.8 Type conversions

Let's define a numeric variable.

```
numeric_var <- 12.5
```

Let's try to convert the numeric object to a character type using the `as.character()` function. As you may have guessed, `as.character()` tries to convert whatever object given inside its parentheses (i.e., its “argument”) to a character type.

```
# apply as.character() to numeric_var
as.character(numeric_var)
```

```
[1] "12.5"
```

Did it work? Notice that the 12.5 has some quotes around it now. That means that it's not a numeric value anymore. It's now a *text* (character) value that contains a number. This means that you can't do math with it.

But just to prove it to you, I'm going to try anyway (and unsurprisingly, I get an error):

```
as.character(numeric_var) * 5
```

```
Error in as.character(numeric_var) * 5: non-numeric argument to binary operator
```

To confirm that `as.character(numeric_var)` is indeed a character, I can apply the `class()` function to the character value created by `as.character(numeric_var)` by placing `as.character(numeric_var)` inside the `class()` parentheses:

```
class(as.character(numeric_var))
```

```
[1] "character"
```

This code is “nesting” the `class()` and `as.character()` functions.

Do you think that running the `as.character(numeric_var)` code has *modified* the original `numeric_var` object at all (i.e., does using `as.character()` on a variable actually convert that variable to a character type... or does it just print out the character type version of the variable)?

You can check by just outputting the `numeric_var` object by typing its name:

```
numeric_var
```

```
[1] 12.5
```

Notice there are no quotes, so it’s still a numeric-type object. We can also confirm this using the `class` function:

```
class(numeric_var)
```

```
[1] "numeric"
```

If we wanted to update the `numeric_var` object so that it had a character type, we would need to “reassign” it to the output of `as.character(numeric_var)`. This would overwrite the old `numeric_var` and replace it with the new character version. I don’t want to do this though, so I’m not going to run this code.

```
# To overwrite numeric_var with a character version, run:  
numeric_var <- as.character(numeric_var)  
numeric_var
```

```
[1] "12.5"
```

Just as there is an `as.character()` function, there is also an `as.numeric()` function (there's also an `as.logical()` function, but I don't think I've ever actually had used it)

Rather than bore you to bits by outlining all of the possible conversions you can do with `as.numeric()` and `as.character()`, you're going to do it for me. Use the `as.numeric()` and `as.character()` functions to fill in the following table (I've already filled in the first row for you):

| value   | Original type | <code>as.character(value)</code> | <code>as.numeric(value)</code> |
|---------|---------------|----------------------------------|--------------------------------|
| 12.5    | numeric       | "12.5"                           | 12.5                           |
| TRUE    | logical       |                                  |                                |
| FALSE   | logical       |                                  |                                |
| "howdy" | character     |                                  |                                |
| "99"    | character     |                                  |                                |
| "1,200" | character     |                                  |                                |

Pay close attention to which `value` entries have quotes and which values do not.

Did any of these results surprise you?

When you run `as.numeric("howdy")` or `as.numeric("1,200")`, you should get an `NA` value, which is a *missing value*, along with a warning:

```
as.numeric("howdy")
```

Warning: NAs introduced by coercion

```
[1] NA
```

Unlike an error, which means that your code did not actually run, when you get a *warning*, your code has run, but R is telling you it's not happy with you. When you get a warning, it's a good idea to take a pause and consider that perhaps your code may not have done what you expected.

The warning `NAs introduced by coercion` happens when you try to convert characters to numbers. **Characters cannot be converted to numbers**, unless the character contains a number without any additional characters, as you should have seen when filling in your table above.

This means that this works:

```
as.numeric("99")
```

```
[1] 99
```

But this does not:

```
as.numeric("1,200")
```

```
Warning: NAs introduced by coercion
```

```
[1] NA
```

1,200 may look like a number, but the presence of the comma , means that R cannot parse the number inside the quotes. What is obvious to us is not always obvious to our computer overlords.

### 💡 Extracting numeric values from characters

If you do want to convert a character containing a number, such as "1,200" to a numeric type, you can use the `parse_number()` function from the “readr” R library. You’ll learn more about libraries in future chapters, so don’t worry about running this code now—I just wanted to let you know that this exists!

```
# uncomment and run the next line of code to install the "readr" library:  
# install.packages("readr")
```

```
library(readr)  
parse_number("1,200")
```

```
[1] 1200
```

```
parse_number("I have 49 bananas")
```

```
[1] 49
```

## 3.9 NA values

Let's talk briefly about the `NA` value (missing values). They are everywhere. You will often find that once they make their way into your data in R, missing values have a way of permeating your existence.

A missing value, `NA`, is a special type of object. Like `TRUE` and `FALSE`, your `NA` must be in all caps (i.e., you must yell when you type it).

For example, this is the `NA` value:

```
NA
```

```
[1] NA
```

But R thinks that the lowercase version, `na`, is a variable (and R then complains when I type `na` because I haven't defined a variable called `na`):

```
na
```

```
Error in eval(expr, envir, enclos): object 'na' not found
```

`NA` values are annoying mostly because the result of any mathematical operation with an `NA` is always `NA`:

```
NA + 5
```

```
[1] NA
```

```
NA * 0
```

```
[1] NA
```

Armed with the knowledge that character values will be converted to `NA` when you apply `as.numeric()`, but numeric values can be converted to character values using `as.character()` just fine, try the following exercise.

## 3.10 Exercise

Without running the following pieces of code, which of the following pieces of code will work, and what do you think the output will be?

```
as.numeric("TRUE") + 3
```

```
as.character(TRUE + 12)
```

```
as.character(as.numeric("35"))
```

## 3.11 Solution

```
as.numeric("TRUE") + 3
```

Warning: NAs introduced by coercion

```
[1] NA
```

```
as.character(TRUE + 12)
```

```
[1] "13"
```

```
as.character(as.numeric("35"))
```

```
[1] "35"
```

## 3.12 Asking questions with logical operations

Let's go ahead and create two brand-new numeric variables, `x` and `y`:

```
x <- 2  
y <- 4
```

I'm now going to ask R some questions about `x` and `y`.

First question: “*Is x equal to 2?*”

```
x == 2
```

```
[1] TRUE
```

R answered “Yes!” But in R, “Yes!” is TRUE.

To ask a question of equality, we used two equals symbols ==.

Next question: “Is *x* less than or equal to 1?”

```
x <= 1
```

```
[1] FALSE
```

Again, R came through with an answer (this time FALSE). To ask a question of “less than or equal to”, we used a “less than” symbol < followed by an equals symbol =, giving me <=.

Although both == and <= kind of look like the assignment operators = and <- , they’re not affiliated in any way.

== and <= are “question asking” operators, or “*logical operators*” if you want to sound fancy (they’re called “logical operators” because they always result in a TRUE or FALSE logical result).

Before we asked if x was equal to 2 (x == 2), but we can also ask whether x is equal to y:

```
x == y
```

```
[1] FALSE
```

As well as “is x *not* equal to y” using the “not equal to” logical question operator of an exclamation point followed by an equals symbol != (not equals):

```
x != y
```

```
[1] TRUE
```

In fact, for any logical question we ask, we can ask its *inverse* by placing the original question in parentheses and prefacing it with a !. So the following is another way to ask x != y:

```
!(x == y)
```

```
[1] TRUE
```

The parentheses are necessary to tell R that we want the inverse of the entire question `x == y` (not just of `x`).

Here are some more questions:

“Is `x` strictly greater than `y`? ”

```
x > y
```

```
[1] FALSE
```

“Is `x` greater than or equal to `y`? ”

```
x >= y
```

```
[1] FALSE
```

“Is `x` strictly less than `y`? ”

```
x < y
```

```
[1] TRUE
```

It’s almost like we’re talking to R and it’s *replying!* This is going to be really important later, since we will use these kinds of logical operations to filter to various subsets of our data based on logical conditions/questions.

# 4 Vectors

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## 4.1 Defining a vector

While being able to store numbers and text in a variable, such as `x <- 12`, is super neat, the real power of variables is being able to store a wide variety of objects, including an entire dataset, model, or even a data visualization!

However, before we try to create an object containing an entire dataset, let's start with a variable that contains just a collection of values, such as might appear in a single column of a dataset.

The kind of object that contains a collection of values is called a **vector**. Let's create a vector that contains the ages of 5 people and store it in a variable called `age`:

```
age <- c(12, 19, 22, 35, 18)
```

Just like our variables in the previous chapters, we can look at the contents of `age` by typing its name:

```
age
```

```
[1] 12 19 22 35 18
```

But unlike our previous variables, `age` contains many values, and this is because `age` is a vector, which is defined by “concatenating” values together using the `c()` function.

Note that the `[1]` at the beginning of the output is just telling you that the first value is at index position/location 1 (i.e., that it is the *first* entry). If our vector is so long that its output spills onto multiple lines, such as the vector below, notice that the second line in the

output has a different number inside the square parentheses. This is just telling you which index position the *first entry on the second* line has (and it may change based on the width of your window when the code was run).

```
long_age <- c(12, 19, 22, 35, 18, 44, 23, 56, 23, 12, 18, 19, 50, 60, 77, 54,
            34, 66, 34, 32, 19, 20, 21, 18, 19, 72, 27, 43, 63, 23, 12, 18,
            19, 50, 60, 77, 54)
long_age

[1] 12 19 22 35 18 44 23 56 23 12 18 19 50 60 77 54 34 66 34 32 19 20 21 18 19
[26] 72 27 43 63 23 12 18 19 50 60 77 54
```

The `c()` function asks R to place all of the values provided inside the parentheses of `c()`, which are separated by commas, into a single vector object.

You might think that when we apply `class()` to our `age` vector object, it would return “vector”. However, the *type* or *class* of a vector is actually just the *type* or *class* of the values it contains, which in this case, is “numeric”

```
class(age)
```

```
[1] "numeric"
```

This means that if we had created a vector of names, such as the one below:

```
names <- c("Dean", "Xiao", "Sara", "Ravi", "Maya")
names
```

```
[1] "Dean" "Xiao" "Sara" "Ravi" "Maya"
```

Then our `names` vector object will have class “character”:

```
class(names)
```

```
[1] "character"
```

Vectors are great. Rather than having to carry around all of my individual numbers and words individually, I can put them all into a little vector “bag” and carry them around together.

However, vectors are a little bit particular. Let’s try and create a vector that contains multiple different types of values, such as numbers and text:

```
multi_vec <- c(1, 9, "banana", 10, -1)
multi_vec
```

```
[1] "1"      "9"      "banana" "10"      "-1"
```

What class/type do you think this `multi_vec` vector will have? Take a close look at the values in the `multi_vec` output above. Notice the quotes around the numbers. Let's check the class of `multi_vec`:

```
class(multi_vec)
```

```
[1] "character"
```

Interesting. `multi_vec` is a character vector, despite the fact that most of the values used to create it were numbers.

This is because **vectors can only contain values of a single type**.

R will let you create a vector using values of multiple different types (such as numbers and characters), but in the actual vector object that is created, all of the values will be *converted* to the same type, in this example, that type was “character”.

What do you think will happen if we try to create a vector with numeric and logical values (TRUE/FALSE) values? Below I try to combine some numbers with a TRUE and a FALSE into the same vector.

```
multi_vec2 <- c(1, 5, TRUE, FALSE, -9)
```

Notice how the output when I print the name of the object differs from the object I defined above:

```
multi_vec2
```

```
[1] 1 5 1 0 -9
```

What has happened here? Just like R converted my numbers to a character when a character value was present in the vector, here, R has converted my logical values (my TRUE and FALSE values) to numbers (corresponding to 1 and 0, respectively).

How can you tell what type a vector will have when it is created using values of various different types? It turns out that there is a hierarchy of types:

### Character > Numeric > Logical

This doesn't mean that characters are better than numerics and logicals, but rather this means that if a character value is present among the values that define the vector, then all values in the vector will be converted to the character type. If there are no characters being used to define the vector, but there are numeric values and logical values, then all of the values will be converted to the numeric type.

## 4.2 Exercise

Before you run the code below, predict what vector will be created from the code below. Consider the type hierarchy above.

```
vector_example <- c(TRUE, 4, "hello", FALSE, 0)
```

## 4.3 Solution

Since the vector definition includes a character value, all values in the resulting vector have a character type (notice the quotes)

```
vector_example <- c(TRUE, 4, "hello", FALSE, 0)  
vector_example
```

```
[1] "TRUE"   "4"      "hello"  "FALSE"  "0"
```

```
class(vector_example)
```

```
[1] "character"
```

## 4.4 Working with vectors: vectorization

While it's super neat that we can collect all of our numbers and words in a single vector object (although no mixing of words and numbers), the actual cool thing about vectors is that it makes it really easy to do computations on all of our values at once.

If we define our `age` vector below:

```
age <- c(12, 18, 22, 21, 17)
```

Then we can demonstrate a really neat property of vectors: if I subtract 1 from the vector object `age`, R will subtract 1 from *every value in the vector* at once:

```
age - 1
```

```
[1] 11 17 21 20 16
```

Let's create an entirely new vector object, that I'm going to creatively call `age2`, which contains the original `age` vector multiplied by 2.

```
age2 <- age * 2
```

If we want to look at what values `age2` contains, we can print out its name, and lo and behold, all of the values in `age2` correspond to the original values in `age`, multiplied by 2:

```
age2
```

```
[1] 24 36 44 42 34
```

The fact that mathematical operations applied to a vector are applied separately to each individual value in the vector is called **vectorization**.

While this might not seem *that* cool to you. Trust me when I say that this 100% *is* cool. Imagine how tired your fingers would get if you had to subtract 1 from every individual value in a vector containing 1000 values. With vectorization, I just have to subtract 1 from the vector object itself, and I'm done.

So now that we have two age vectors, `age` and `age2`, which are both printed below:

```
age
```

```
[1] 12 18 22 21 17
```

```
age2
```

```
[1] 24 36 44 42 34
```

What do you think will happen if I try to add these two vectors together?

```
age2 + age
```

```
[1] 36 54 66 63 51
```

Because vectors are *vectorized*, the entries were added *element-wise*. This means that the first value in `age` was added to the first value in `age2`, and similarly for the second value, and so on.

Note that in the `age2 + age` computation above, I printed out the resulting vector, but I did not *save* this vector as an object. Having been computed, the `age2 + age` vector has now been lost to the ether. If I wanted to use this resulting vector for something, I would need to *save* it as a new variable (such as `age3 <- age2 + age`).

Since we can add vectors together, it follows that we can probably also subtract them from one another and multiply them by one another, and all of these operations will happen *element-wise*. For example, we can divide `age2` by `age`, and we will get a vector containing 5 2s, because each entry in `age2` is twice the corresponding entry in `age`:

```
age2 / age
```

```
[1] 2 2 2 2 2
```

In this example, both `age` and `age2` have the same *length*. That is, they have the same number of entries.

What do you think will happen if we try to do a computation with vectors of different lengths? Let's try to subtract a vector of length 2 (`c(1, 2)`) from `age`, which has length 5:

```
age - c(1, 2)
```

```
Warning in age - c(1, 2): longer object length is not a multiple of shorter
object length
```

```
[1] 11 16 21 19 16
```

Interestingly, it worked, but we got a warning message “*longer object length is not a multiple of shorter object length*”. Take a look at the output of the code above. Can you figure out what R did here?

R is being very presumptuous. Without even bothering to ask me, it went ahead and repeated the values in the shorter vector, `c(1, 2)`, to match the length of the longer vector, `age`, i.e., until it gets to 5 values in total, so it is essentially doing this:

```
age = c(1, 2, 1, 2, 1)
```

```
[1] 11 16 21 19 16
```

Personally, I'd prefer if R gave me an error when I try to do mathematical operations with vectors of different lengths. But unfortunately for me, I didn't write the R programming language, I just use it.

To be fair, R did provide a *warning* that I was trying to do a computation with vectors of different lengths. But it's really easy to unintentionally ignore warnings.

If you ever see this warning, it probably means that you've made a mistake somewhere. I can guarantee that you almost never actually want to do mathematical operations with vectors of different lengths.

In summary, my advice is *don't ignore* the warning message "*longer object length is not a multiple of shorter object length*". Check your lengths and check your code output!

Speaking of "checking your lengths", it might be helpful if I told you how to do that! You can compute the length of a vector by applying the `length()` function to it:

```
length(age)
```

```
[1] 5
```

#### 4.4.1 Vectorized logical operations

Do you remember when we asked questions about the values we stored in our variables/objects, like `x == 1`? Well, it turns out that we can ask the same questions of vectors! And, you guessed it, those questions will be asked *element-wise*.

Let's keep working with our `age` vector:

```
age
```

```
[1] 12 18 22 21 17
```

If we ask "which `age` entries are greater or equal to 18" using the code below:

```
age >= 18
```

```
[1] FALSE TRUE TRUE TRUE FALSE
```

This question gets asked separately for every entry in `age`. The resulting logical vector above is TRUE for the `age` entries that are 18 or above, and is FALSE for the `age` entries that are less than 18.

Let's ask another question: "which `age` entries are equal to 17"?

```
age == 17
```

```
[1] FALSE FALSE FALSE FALSE TRUE
```

It looks like only the last one is.

What about "which `age` entries are *not* equal to 21"?

```
age != 21
```

```
[1] TRUE TRUE TRUE FALSE TRUE
```

What if we want to ask which `age` entries are equal to *either* 17 or 18? The natural thing to try is:

```
age == c(17, 18)
```

Warning in `age == c(17, 18)`: longer object length is not a multiple of shorter object length

```
[1] FALSE TRUE FALSE FALSE TRUE
```

But notice our longer object length is not a multiple of shorter object length warning!

If we take a look at `age` again,

```
age
```

```
[1] 12 18 22 21 17
```

It looks like `age == c(17 18)` gave us the right answer (as in, we got TRUE for the second and fifth entries), but I never like to ignore a “*longer object length is not a multiple of shorter object length*” warning message.

Since the code `age == c(17, 18)` worked, it should probably also work if we switch the order of 18 and 17 in our question, right?

```
age == c(18, 17)
```

```
Warning in age == c(18, 17): longer object length is not a multiple of shorter
object length
```

```
[1] FALSE FALSE FALSE FALSE FALSE
```

This time we still get some output, along with our “longer object length is not a multiple of shorter object length” warning, but the answer is *wrong*. All of the entries in the output vector are FALSE.

This is because R is doing that pesky recycling thing again. This question is equivalent to:

```
age == c(18, 17, 18, 17, 18)
```

```
[1] FALSE FALSE FALSE FALSE FALSE
```

And the question is being asked element-wise (is the first entry equal to 18? Is the second entry equal to 17? Is the third entry equal to 18?). The only reason we got the correct answer the first time is because we got lucky with our recycling.

The moral of the story is: *don't ignore* the warning message “*longer object length is not a multiple of shorter object length*”. Check your lengths!

#### 4.4.2 The `%in%` operator

Okay, so if `age == c(17, 18)` isn't how we ask the question of which `age` entries are equal to 17 or 18, how *do* we ask that question?

We are going to use a new operator, `%in%`. To use `%in%`, just replace `==` in the question above, with `%in%`!

```
# use %in% to ask which entries in age are equal to 17 or 18
age %in% c(17, 18)
```

```
[1] FALSE TRUE FALSE FALSE TRUE
```

*Et voila!* This time it tells us that the second and fifth entries are equal to either 17 or 18, *and* we didn't get any warnings! Yay!

## 4.5 Summary functions for vectors

So I showed you earlier that you can use the `length()` function to compute the number of values in a vector, but this is just one of many functions you can use to summarize a vector.

For example, the `sum()` function can be used to add up all the entries in a (numeric) vector:

```
sum(age)
```

```
[1] 90
```

The `mean()` function computes the mean/average:

```
mean(age)
```

```
[1] 18
```

The `median()` function computes the median:

```
median(age)
```

```
[1] 18
```

The `var()` function computes the variance:

```
var(age)
```

```
[1] 15.5
```

The `sd()` function computes the standard deviation:

```
sd(age)
```

```
[1] 3.937004
```

The function `length()` tells you how many entries the vector contains:

```
length(age)
```

```
[1] 5
```

The `min()` function tells you the smallest value:

```
min(age)
```

```
[1] 12
```

And the `max` function tells you the biggest value:

```
max(age)
```

```
[1] 22
```

And we can combine some of the super fun logical stuff from above with `sum()` to compute even more interesting summaries.

First, note that when you apply `sum()` (or `mean()`) to a vector of *logical* values, it treats `FALSE` as 0 and `TRUE` as 1. So when you apply `sum()` to a logical vector, it adds up the number of `TRUE` values:

```
# compute the number of TRUE values
sum(c(TRUE, FALSE, FALSE, TRUE))
```

```
[1] 2
```

So we can use this to do things like add up the number of values in `age` that are either 17 or 18:

```
sum(age %in% c(17, 18))
```

```
[1] 2
```

Or add the number of values in `age` that are strictly greater than 15:

```
sum(age > 15)
```

```
[1] 4
```

## 4.6 Exercise

Try to use the functions above to compute the *proportion* of people whose age is strictly greater than 15

## 4.7 Hint

Consider using the `sum()` function and the `length()` function.

## 4.8 Solution

```
sum(age > 15) / length(age)
```

```
[1] 0.8
```

## 4.9 Extracting information from vectors

We know how to put values into a vector (i.e., using `c()`), but how do we get them out again?

To extract values from a vector, you can type the name of the vector that you want to extract the values from, followed by some square parentheses `[]`, inside which you place the numeric location (index) of the value you want to extract.

Let's keep working with `age`:

```
age
```

```
[1] 12 18 22 21 17
```

To extract the first entry from `age`:

```
age[1]
```

```
[1] 12
```

To extract the fourth entry from `age`:

```
age[4]
```

```
[1] 21
```

If you want to extract the final entry in a vector and you don't immediately know its length, you can do something clever like this:

```
age[length(age)]
```

```
[1] 17
```

Why does this work? Remember that `length(age)` tells you how many values there are in `age` (i.e., 5), and so this is equivalent to `age[5]`, which will extract the final value from the `age` vector.

#### 4.9.1 Removing a value from a vector

If I wanted to *extract* the first entry from `age`, I would write, `age[1]`. This is actually essentially creating a new vector that just consists of the first value in `age` (although I haven't saved this vector anywhere).

If I wanted to instead create a new vector that *removed* this first entry, I would write

```
# remove the first entry from age  
age[-1]
```

```
[1] 18 22 21 17
```

So `age[1]` extracts the first entry from `age` and `age[-1]` removes the first entry from `age`.

Keep in mind that none of these operations so far have modified the original `age` object:

```
age
```

```
[1] 12 18 22 21 17
```

`age[1]` prints the result of extracting the first entry from `age`, but I am not saving this result, nor am I overwriting our `age` vector with this value. Remember that the output of your code is only saved when you assign the result of the computation to something using `<-!`

## 4.10 Exercise

Remove the fourth entry from `age`

```
age <- c(12, 18, 22, 21, 17)
```

## 4.11 Solution

```
age[-4]
```

```
[1] 12 18 22 17
```

### 4.11.1 Extracting/removing multiple entries from a vector

So far we have just extracted and removed a single entry from `age` at a time. But often, we want to be able to extract or remove multiple entries at once. That is, I want to provide multiple values inside my square parentheses [ ], but they only accept one value!

Let's quickly remind ourselves of what `age` contains:

```
age
```

```
[1] 12 18 22 21 17
```

If I try to provide two values inside my [ ] parentheses, I get an error. For example, below, I try to extract both the first and third entries (12 and 22) from `age` at once by just providing two numbers inside the square parentheses:

```
age[1, 3]
```

```
Error in age[1, 3]: incorrect number of dimensions
```

But I got an error :(. The error "incorrect number of dimensions" is telling me that it only wants one object, not two inside the square parentheses!

So I need to provide two position values (1 and 3), but I can only provide one object inside. How could I create *one* object that contains *two* values? One object... two values... Hmmmmmmmm. Have you figured it out yet? Why don't you put the two values inside a *vector*! Wow! Neat idea!

Let's try and extract the first and third entries from `age` at once, by providing a vector `c(1, 3)` inside the square parentheses:

```
age[c(1, 3)]
```

```
[1] 12 22
```

It worked!

Maybe we can also remove the first and third entries by providing the negative of this vector:

```
age[-c(1, 3)]
```

```
[1] 18 21 17
```

That worked too! Vectors are great.

## 4.12 Defining integer sequences

What if you wanted to define a really long vector of sequential integers like:

```
my_long_vector <- c(101, 102, 103, 104, 105, 106, 107, 108, 109, 110,
  111, 112, 113, 114, 115, 116, 117, 118, 119, 120,
  121, 122, 123, 124, 125, 126, 127, 128, 129, 130,
  131, 132, 133, 134, 135, 136, 137, 138, 139, 140,
  141, 142, 143, 144, 145, 146, 147, 148, 149, 150,
  151, 152, 153, 154, 155, 156, 157, 158, 159, 160,
  161, 162, 163, 164, 165, 166, 167, 168, 169, 170,
  171, 172, 173, 174, 175, 176, 177, 178, 179, 180,
  181, 182, 183, 184, 185, 186, 187, 188, 189, 190,
  191, 192, 193, 194, 195, 196, 197, 198, 199, 200)
```

```
my_long_vector
```

```
[1] 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118
[19] 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136
[37] 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154
[55] 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172
[73] 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190
[91] 191 192 193 194 195 196 197 198 199 200
```

Writing this out made my fingers really tired. And if you've learned anything about me so far, you'll know how much I hate it when my fingers get tired.

Fortunately, there's a better way. If I want to define a vector containing a sequence of consecutive integers like in `my_long_vector`, I can use the `:` syntax. For example, to create the vector `c(1, 2, 3, 4)`, I could write:

```
1:4
```

```
[1] 1 2 3 4
```

Note that I haven't saved this vector (I just wrote the code to create it and then the result was printed and subsequently lost to the ether), but I could if I wanted to. Below, I save the above vector in an object called `vector1to4`:

```
vector1to4 <- 1:4
```

And then I can access this vector by writing its name:

```
vector1to4
```

```
[1] 1 2 3 4
```

The syntax to create a sequential vector of integers is `start:stop`. So if `1:4` created the vector `c(1, 2, 3, 4)`, how might you create the long vector I saved in `my_long_vector` above? Well the starting value is 101 and the last (stop) value is 200, so maybe we can try `101:200`:

```
101:200
```

```
[1] 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118  
[19] 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136  
[37] 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154  
[55] 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172  
[73] 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190  
[91] 191 192 193 194 195 196 197 198 199 200
```

Perfecto!

The cool thing about this is that we can use it to *extract* segments of a vector, for instance, to extract the first four entries of `age`, we could write

```
age[1:4]
```

```
[1] 12 18 22 21
```

## 4.13 Logical subsetting

Sometimes you might want to extract all the entries from a vector that satisfy a certain condition. To do that, you first need to understand how to use a logical vector to extract values.

If I provide a vector of `TRUE`s and `FALSE`s inside the square parentheses, R will extract all the values whose corresponding entry in the logical vector are `TRUE`.

For example, the following code will extract the first, fourth, and fifth entries:

```
age[c(TRUE, FALSE, FALSE, TRUE, TRUE)]
```

```
[1] 12 21 17
```

OK. So I would never actually write out such a vector, because I have a life, but remember when we asked logical questions of our vectors, such as, which entries in `age` are greater than or equal to 18?

```
age >= 18
```

```
[1] FALSE TRUE TRUE TRUE FALSE
```

This creates a logical vector for us *and* the TRUE values correspond to the values in the vector for which the condition is true. Do you see where I'm going with this?

If you want to extract all of the values in a vector for which a logical condition is true, you can provide the logical condition inside the square parentheses of the vector!

The following code will extract the values in `age` that are all greater or equal to 18:

```
age[age >= 18]
```

```
[1] 18 22 21
```

This is great for simple conditions, but what about more complex conditions, such as ages that are at least 17 but less than 20? Unfortunately, the R code that would correspond to the mathematical syntax  $17 \leq x \leq 20$  doesn't work in R:

```
17 <= age < 20
```

```
Error: <text>:1:11: unexpected '<'  
1: 17 <= age <  
          ^
```

Instead, we have to combine multiple conditions in R, using `|` if we want *either* condition to be true (the logical "OR") and `&` if we want *both* conditions to be true (the logical "AND").

The condition that the age is at least 17 but less than 20 is the combination of the two conditions `age >= 17` and `age < 20`, and we need both of these things to be true so we can write

```
# age at least 17 and less than 20  
(age >= 17) & (age < 20)
```

```
[1] FALSE TRUE FALSE FALSE TRUE
```

Combining conditions with an `&` will only be TRUE if both conditions are TRUE.

Let's use this "AND" condition to *extract* all of the entries in `age` that are both greater or equal to 17 *and* less than 20.

```
age[(age >= 17) & (age < 20)]
```

```
[1] 18 17
```

On the other hand, combining conditions with an `|` "OR" operator will be TRUE if *either* TRUE (even if the other one is FALSE).

So for example, the ages that are *either* less than 16 *or* greater than 20 are the first, third, and fourth entries

```
(age < 16) | (age > 20)
```

```
[1] TRUE FALSE TRUE TRUE FALSE
```

And we can use this `|` operator to *extract* all of the entries in `age` that are *either* less than 16 *or* greater than 20:

```
age[(age <= 16) | (age > 20)]
```

```
[1] 12 22 21
```

Sorry if your brain hurts.

Let's practice a little.

## 4.14 Exercise

Here is a new vector, `vec`.

```
vec <- c(4, 19, 2, 2, 3, 90, 55, 12)
```

Extract the entries that are less than 10

## 4.15 Solution

```
vec[vec < 10]
```

```
[1] 4 2 2 3
```

## 4.16 Exercise

Extract the entries of `vec` that are less than 25 but greater than 10

## 4.17 Solution

Since I need both `vec < 25` and `vec > 10` to be TRUE, this involves an `&` statement:

```
vec[(vec < 25) & (vec > 10)]
```

```
[1] 19 12
```

## 4.18 Exercise

Extract the entries of `vec` that are either less than 10 or equal to 55

## 4.19 Solution

Since I only need either `vec < 10` and `vec == 55` to be TRUE, this involves an `|` statement:

```
vec[(vec < 10) | (vec == 55)]
```

```
[1] 4 2 2 3 55
```

## 4.20 Named vectors

If we wanted each entry in `age` to have its own name, we could use the `names()` function.

Note that `names(age)` extracts an attribute of `age` (its names, which are currently nonexistent), and by assigning `names(age)` to something, we can update the names.

Below, we update the names of the entries in `age` to be “Dean”, “Xiao”, “Sara”, “Ravi”, and “Maya”, respectively.

```
names(age) <- c("Dean", "Xiao", "Sara", "Ravi", "Maya")
```

Note that this *does* modify the `age` object directly (specifically, it modifies the *names* of `age` through assignment `<-`):

```
age
```

```
Dean Xiao Sara Ravi Maya  
12   18   22   21   17
```

While you can define a vector and then update its names later, you can alternatively create the names when you initially create the vector using the syntax below.

```
age <- c("Dean" = 12, "Xiao" = 18, "Sara" = 22, "Ravi" = 21, "Maya" = 17)  
age
```

```
Dean Xiao Sara Ravi Maya  
12   18   22   21   17
```

Take a look at the output of this “named vector”. How does it look different from the original unnamed `age` vector? The name for each entry appears above the value, and the `[1]` at the beginning of the vector that denotes the first entry is gone! I have no explanation for why this second thing happens.

The cool thing about named vectors is that you can extract an entry from a vector using its name. For example, if I just wanted Ravi’s age, I could write:

```
age["Ravi"]
```

```
Ravi  
21
```

Note that the name of the entry must be a character string, i.e., I have to have quotes around "Ravi".

I can also extract several entries from the vector using a vector of the names I want, just as I did with numbers representing the index positions I wanted to extract:

```
age[c("Maya", "Ravi")]
```

```
Maya Ravi  
17    21
```

## 4.21 Factors

Before moving on to actually working with data (yay!), I want to talk briefly about factors.

Factors are essentially vectors coupled with a set of allowed values. For example, you will often find states (e.g., US states CA, OR, NY, etc) stored as a factor since there are a pre-defined set of states.

As an example, let's create a character vector of 10 Australian states (where some states appear more than once—there are only 7 states total):

```
australia_states <- c("New South Wales", "New South Wales", "Queensland", "Tasmania", "ACT",  
australia_states
```

```
[1] "New South Wales"      "New South Wales"      "Queensland"  
[4] "Tasmania"            "ACT"                  "South Australia"  
[7] "Western Australia"   "Northern Territory"  "New South Wales"  
[10] "Queensland"          "ACT"
```

And let's create a factor variable version of this vector using the `factor()` function:

```
australia_states_fct <- factor(australia_states)  
australia_states_fct
```

```
[1] New South Wales      New South Wales      Queensland        Tasmania  
[5] ACT                 South Australia     Western Australia  Northern Territory  
[9] New South Wales     Queensland         ACT  
7 Levels: ACT New South Wales Northern Territory ... Western Australia
```

What are two differences between the output of the character vector, `australia_states` and the factor `australia_states_fct`?

1. The factor entries are not surrounded by quotes
2. Underneath the factor output some text says 7 Levels: ACT New South Wales ... Western Australia – these list the unique levels in the vector.

Remember that we couldn't convert a character vector to a numeric vector:

```
as.numeric(australia_states)
```

Warning: NAs introduced by coercion

```
[1] NA NA
```

It turns out that we can convert a factor to a numeric vector:

```
as.numeric(australia_states_fct)
```

```
[1] 2 2 4 6 1 5 7 3 2 4 1
```

But what is it doing? It replaces all instances of the first level, `ACT`, with 1, all instances of the second level, `New South Wales`, with 2, etc. This can be very handy, but also very dangerous.

To demonstrate why, let's create a factor containing numbers (factors are not just reserved for text!)

```
fct <- factor(c(5, 1, 1, 3, 6, 5, 5, 6, 1))
fct
```

```
[1] 5 1 1 3 6 5 5 6 1
```

Levels: 1 3 5 6

Notice that the factor *levels* are unique (i.e., 1 only appears once in the levels, even though there are three 1s in the factor itself)

If I try to convert the factor to a numeric variable, the numbers get all messed up:

```
as.numeric(fct)
```

```
[1] 3 1 1 2 4 3 3 4 1
```

What R is doing here is replacing the first level entry, 1, with 1 (so the 1s remain untouched), it is replacing the second level entry, 3, with 2, and replacing the third level entry, 5, with 3, and so on.

It's hard to give concrete advice about factors at this stage because they only really become relevant when you start doing fancy statistical modeling or creating sophisticated graphics using categorical data. For the most part, unless you are using a model that requires factor variables, your life will be slightly easier if you store your categorical/text information as character vectors and your numeric information as numeric vectors rather than factors. Once you get to the modeling stage, you'll see that 80% of the functions that require your categorical data to be a factor will automatically convert them to a factor for you anyway.

# 5 Data Frames

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Let's imagine that you have an actual dataset containing a collection of columns ("variables" in data terminology) and rows ("observations" in data terminology). For example, maybe your dataset is:

| Name | Age | Favorite Color |
|------|-----|----------------|
| Dean | 12  | Blue           |
| Xiao | 18  | Green          |
| Sara | 22  | Red            |
| Ravi | 21  | Purple         |
| Maya | 17  | Blue           |

In this case, your dataset has three "*variables*" (name, age, and favorite color), and five "*observations*" for each of these variables (corresponding to the values for 5 unique people). You might even recognize this data from the previous chapter: the values in the "Age" column are the values from our `age` vector and the names correspond to the names that we gave our `age` vector, along with some extra "Favorite Color" information.

While we could define a separate vector variable in R for each column in our data, such as

```
# three vectors containing info on each person's name, age, and favorite color
name_vec <- c("Dean", "Xiao", "Sara", "Ravi", "Maya")
age_vec <- c(12, 18, 22, 21, 17)
color_vec <- c("blue", 'green', 'red', 'purple', 'blue')
```

Once we started analyzing this data, it would quickly become hard to keep track of which age corresponded to which name, and what their corresponding favorite color is since the variables are each stored in three separate objects. For example, if I look at the `color_vec` vector by typing its name:

```
color_vec
```

```
[1] "blue"   "green"  "red"    "purple" "blue"
```

It isn't clear whose color preference is whose.

It would be much nicer if we could create a *single* object containing all three of these variables such that the corresponding values are “aligned” in such a way that it is very clear that “Ravi” has age 21 and favorite color “purple”.

Fortunately, the creators of R share our desires, so they let us store each of our vectors in an object called a “**data frame**”.

If I already have the columns of my data stored as separate vectors, I can create a data frame using the `data.frame()` function as follows:

```
my_data <- data.frame(name = name_vec,
                       age = age_vec,
                       color = color_vec)
```

Where the name to the left of the `=` symbol in my `data.frame()` arguments defines the corresponding “column name” in my data frame.

Since `my_data` is an R object, I can view it by typing its name:

```
my_data
```

|   | name | age | color  |
|---|------|-----|--------|
| 1 | Dean | 12  | blue   |
| 2 | Xiao | 18  | green  |
| 3 | Sara | 22  | red    |
| 4 | Ravi | 21  | purple |
| 5 | Maya | 17  | blue   |

Now our three variables are neatly arranged in rows and columns, where there is one row for each person and one column for each variable *and* this is all stored in a single variable/object called `my_data`.

The integer numbers 1, 2, 3, 4, and 5 shown along the left-hand side of the rows are not actually a part of the data object itself (notice that there is no “column name” printed above these integers). These numbers are just visual aids provided by the R console when you print a data frame object to make it a little bit easier to count the rows in the data.

If I ask R what kind of object `my_data` is, it tells me it's a “`data.frame`”.

```
class(my_data)
```

```
[1] "data.frame"
```

And I can get a quick summary of what my data frame contains using the `str` function:

```
str(my_data)
```

```
'data.frame': 5 obs. of 3 variables:  
 $ name : chr  "Dean" "Xiao" "Sara" "Ravi" ...  
 $ age  : num  12 18 22 21 17  
 $ color: chr  "blue" "green" "red" "purple" ...
```

In particular, the things that I find helpful in this summary are the number of “obs.” (5) and “variables” (3), and the type/class of each variable shown after its name, which tells me that the `name` and `color` columns have a “chr” (character) type, and the `age` variable has a “num” (numeric) type.

Each column in a data frame can have a different type, but *each entry within a single column must be the same type* (because each column corresponds to a vector).

There are several techniques for extracting the vectors stored in a data frame. For instance, if I wanted to extract the `age` column, or specifically, the vector corresponding to the `age` column, I can write:

```
my_data$age
```

```
[1] 12 18 22 21 17
```

or

```
my_data['age']
```

```
age  
1 12  
2 18  
3 22  
4 21  
5 17
```

These two approaches both extracted the `age` column, but notice that the output of these two column extraction techniques look a little different.

Can you guess why? Hint: What type/class do you think each output object has? Look at its formatting. Learning to recognize what type each object has based on the way it looks is a really helpful skill.

The output of `my_data$age` *looks* is an ordinary vector. I can tell because the values are arranged horizontally, and there is a [1] at the beginning of the output. But this isn't the case for the output of `my_data['age']`. The output here looks more like our data frame output (but with only one column).

Indeed, if I ask R to tell me the class of each of these two objects that I have extracted, I learn that the `my_data$age` object has a “numeric” type (remember that a vector containing numeric values will have a “numeric” type!)

```
class(my_data$age)
```

```
[1] "numeric"
```

And I learn that the `my_data['age']` object has a “data.frame” type:

```
class(my_data['age'])
```

```
[1] "data.frame"
```

Since data frames and vectors have different behaviors, there will be some scenarios where you prefer your extracted column to be a vector, and others where you will prefer your extracted column to be a single-column data frame.

While I occasionally want to extract columns from my data as a vector using one of these techniques, I typically conduct my data analyses and modifications on the data frame object itself. You'll encounter some sophisticated techniques for working with data frames in the next chapter. But first, I want to show you how to load a dataset that you have saved on your computer into a data frame in R.

## 5.1 Loading data from external files

To create the `my_data` data frame object above, I first created the individual vectors, which I then used to define the columns of my data frame within the `data.frame()` function. Imagine if your data had hundreds of observations/values for each of hundreds of variables. No one wants to manually type their data into R.

More often than not, the data you want to analyze will already live in a file on your computer, such as a .csv file or an Excel spreadsheet. In this section, I will show you how to “load” data from such files into an R data frame.

### 5.1.1 Loading data from .csv data files

.csv files are one of the *simplest* data formats. “csv” stands for “comma separated value”. In a .csv file:

- Columns are separated by commas
- New rows are created by starting a new line

The .csv version of our data above looks like this:

```
name, age, color
Dean, 12, blue
Xiao, 18, green
Sara, 22, red
Ravi, 21, purple
Maya, 17, blue
```

To load in a dataset (as a data frame) from a .csv file, we can use the `read.csv()` function. However, for R to be able to find your file you need to provide a “filepath” argument (as a character/text value) to your csv file.

The file path corresponds to the location where your file lives on your computer relative to where the current R file you are working in is saved. Ideally, you are working in a quarto document. If so, identify where on your computer you have saved your quarto document. If your csv data file lives in the same folder as your quarto document, then you will write

```
data <- read.csv("filename.csv")
```

where you replace "filename.csv" with the actual file name of your .csv file.

If your .csv data file lives in a `data/` subfolder, then you will write

```
data <- read.csv("data/filename.csv")
```

When you compile a quarto document (which will involve sequentially running all of the code in the code chunks), R automatically searches for any referenced files in the folder where the quarto document is saved.

However, if you run the code in the console, R might not automatically know to look for files in the same folder as your quarto document. To ensure R can locate your files, your console's working directory needs to match the folder containing your quarto document. The **working directory** is the folder where your R console looks for files to load (and where it saves any files you create).

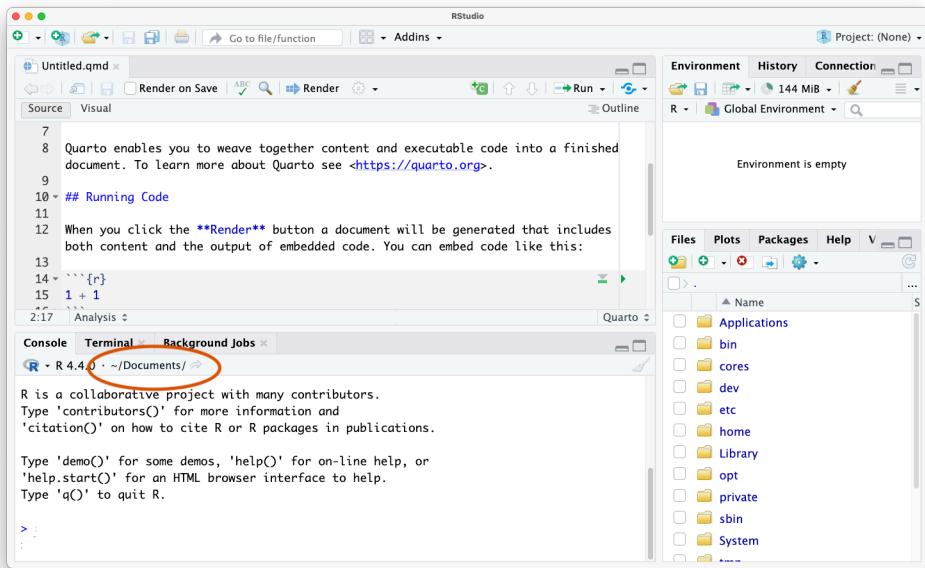
All file paths in code that is run in the console are relative to your console's current working directory, regardless of where your quarto document is saved.

If you open RStudio by directly opening a quarto document or an R script, the working directory is typically set to the folder containing that file. However, if you open your IDE without opening a specific file, the working directory is likely set to your computer's home folder.

If the console's working directory doesn't match the folder where your quarto document or R script is saved (the location of the code you're running), R won't be able to find your data files.

### Identifying the console's current working directory

You can see your console's current working directory by looking at the top of the console. In the image below, the working directory is the "Documents" folder. If you just see ~, then your console's current working directory is your computer's home folder.



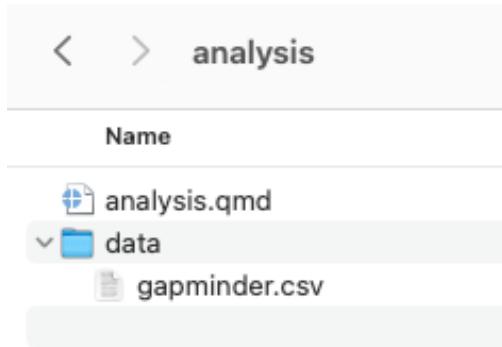
### Changing your console's working directory

It is recommended that your working directory matches the location of the quarto document you are working in.

You can update your console's working directory to be the location of your current quarto document in RStudio by choosing “Session > Set Working Directory > To Source File Location”.

Let's load an actual .csv file. If you are working in a quarto document or an R script on your computer, take note of where you saved it. Then [download the following “data” folder containing the “gapminder” dataset](#) and move the data folder to the same location as your current quarto document.

If you are working in a quarto document called “analysis.qmd” then your folder should have the following structure, in which the “data” folder lives in the same place as “analysis.qmd”:



Then, assuming that your console's working directory matches the location of your quarto document on your computer, you should be able to run the code below to load in the `gapminder.csv` data file and save it as a data frame object called `gapminder`:

```
gapminder <- read.csv(file = "data/gapminder.csv")
```

If you get an error that says "Warning message: In file(file, "rt") : cannot open file 'data/gapminder.csv': No such file or directory", this means that either you did not move the "data" folder containing "gapminder.csv" in the right place, or your console's working directory is incorrect!

Hopefully you figured out how to tell R to find and load your dataset! If your code above worked, you should then be able to take a look at the `gapminder` object by typing its name:

```
gapminder
```

|    | country     | continent | year | lifeExp  | pop      | gdpPercap |
|----|-------------|-----------|------|----------|----------|-----------|
| 1  | Afghanistan | Asia      | 1952 | 28.80100 | 8425333  | 779.4453  |
| 2  | Afghanistan | Asia      | 1957 | 30.33200 | 9240934  | 820.8530  |
| 3  | Afghanistan | Asia      | 1962 | 31.99700 | 10267083 | 853.1007  |
| 4  | Afghanistan | Asia      | 1967 | 34.02000 | 11537966 | 836.1971  |
| 5  | Afghanistan | Asia      | 1972 | 36.08800 | 13079460 | 739.9811  |
| 6  | Afghanistan | Asia      | 1977 | 38.43800 | 14880372 | 786.1134  |
| 7  | Afghanistan | Asia      | 1982 | 39.85400 | 12881816 | 978.0114  |
| 8  | Afghanistan | Asia      | 1987 | 40.82200 | 13867957 | 852.3959  |
| 9  | Afghanistan | Asia      | 1992 | 41.67400 | 16317921 | 649.3414  |
| 10 | Afghanistan | Asia      | 1997 | 41.76300 | 22227415 | 635.3414  |
| 11 | Afghanistan | Asia      | 2002 | 42.12900 | 25268405 | 726.7341  |
| 12 | Afghanistan | Asia      | 2007 | 43.82800 | 31889923 | 974.5803  |
| 13 | Albania     | Europe    | 1952 | 55.23000 | 1282697  | 1601.0561 |
| 14 | Albania     | Europe    | 1957 | 59.28000 | 1476505  | 1942.2842 |

|    |           |          |      |          |          |            |
|----|-----------|----------|------|----------|----------|------------|
| 15 | Albania   | Europe   | 1962 | 64.82000 | 1728137  | 2312.8890  |
| 16 | Albania   | Europe   | 1967 | 66.22000 | 1984060  | 2760.1969  |
| 17 | Albania   | Europe   | 1972 | 67.69000 | 2263554  | 3313.4222  |
| 18 | Albania   | Europe   | 1977 | 68.93000 | 2509048  | 3533.0039  |
| 19 | Albania   | Europe   | 1982 | 70.42000 | 2780097  | 3630.8807  |
| 20 | Albania   | Europe   | 1987 | 72.00000 | 3075321  | 3738.9327  |
| 21 | Albania   | Europe   | 1992 | 71.58100 | 3326498  | 2497.4379  |
| 22 | Albania   | Europe   | 1997 | 72.95000 | 3428038  | 3193.0546  |
| 23 | Albania   | Europe   | 2002 | 75.65100 | 3508512  | 4604.2117  |
| 24 | Albania   | Europe   | 2007 | 76.42300 | 3600523  | 5937.0295  |
| 25 | Algeria   | Africa   | 1952 | 43.07700 | 9279525  | 2449.0082  |
| 26 | Algeria   | Africa   | 1957 | 45.68500 | 10270856 | 3013.9760  |
| 27 | Algeria   | Africa   | 1962 | 48.30300 | 11000948 | 2550.8169  |
| 28 | Algeria   | Africa   | 1967 | 51.40700 | 12760499 | 3246.9918  |
| 29 | Algeria   | Africa   | 1972 | 54.51800 | 14760787 | 4182.6638  |
| 30 | Algeria   | Africa   | 1977 | 58.01400 | 17152804 | 4910.4168  |
| 31 | Algeria   | Africa   | 1982 | 61.36800 | 20033753 | 5745.1602  |
| 32 | Algeria   | Africa   | 1987 | 65.79900 | 23254956 | 5681.3585  |
| 33 | Algeria   | Africa   | 1992 | 67.74400 | 26298373 | 5023.2166  |
| 34 | Algeria   | Africa   | 1997 | 69.15200 | 29072015 | 4797.2951  |
| 35 | Algeria   | Africa   | 2002 | 70.99400 | 31287142 | 5288.0404  |
| 36 | Algeria   | Africa   | 2007 | 72.30100 | 33333216 | 6223.3675  |
| 37 | Angola    | Africa   | 1952 | 30.01500 | 4232095  | 3520.6103  |
| 38 | Angola    | Africa   | 1957 | 31.99900 | 4561361  | 3827.9405  |
| 39 | Angola    | Africa   | 1962 | 34.00000 | 4826015  | 4269.2767  |
| 40 | Angola    | Africa   | 1967 | 35.98500 | 5247469  | 5522.7764  |
| 41 | Angola    | Africa   | 1972 | 37.92800 | 5894858  | 5473.2880  |
| 42 | Angola    | Africa   | 1977 | 39.48300 | 6162675  | 3008.6474  |
| 43 | Angola    | Africa   | 1982 | 39.94200 | 7016384  | 2756.9537  |
| 44 | Angola    | Africa   | 1987 | 39.90600 | 7874230  | 2430.2083  |
| 45 | Angola    | Africa   | 1992 | 40.64700 | 8735988  | 2627.8457  |
| 46 | Angola    | Africa   | 1997 | 40.96300 | 9875024  | 2277.1409  |
| 47 | Angola    | Africa   | 2002 | 41.00300 | 10866106 | 2773.2873  |
| 48 | Angola    | Africa   | 2007 | 42.73100 | 12420476 | 4797.2313  |
| 49 | Argentina | Americas | 1952 | 62.48500 | 17876956 | 5911.3151  |
| 50 | Argentina | Americas | 1957 | 64.39900 | 19610538 | 6856.8562  |
| 51 | Argentina | Americas | 1962 | 65.14200 | 21283783 | 7133.1660  |
| 52 | Argentina | Americas | 1967 | 65.63400 | 22934225 | 8052.9530  |
| 53 | Argentina | Americas | 1972 | 67.06500 | 24779799 | 9443.0385  |
| 54 | Argentina | Americas | 1977 | 68.48100 | 26983828 | 10079.0267 |
| 55 | Argentina | Americas | 1982 | 69.94200 | 29341374 | 8997.8974  |
| 56 | Argentina | Americas | 1987 | 70.77400 | 31620918 | 9139.6714  |
| 57 | Argentina | Americas | 1992 | 71.86800 | 33958947 | 9308.4187  |

|     |            |          |      |          |          |            |
|-----|------------|----------|------|----------|----------|------------|
| 58  | Argentina  | Americas | 1997 | 73.27500 | 36203463 | 10967.2820 |
| 59  | Argentina  | Americas | 2002 | 74.34000 | 38331121 | 8797.6407  |
| 60  | Argentina  | Americas | 2007 | 75.32000 | 40301927 | 12779.3796 |
| 61  | Australia  | Oceania  | 1952 | 69.12000 | 8691212  | 10039.5956 |
| 62  | Australia  | Oceania  | 1957 | 70.33000 | 9712569  | 10949.6496 |
| 63  | Australia  | Oceania  | 1962 | 70.93000 | 10794968 | 12217.2269 |
| 64  | Australia  | Oceania  | 1967 | 71.10000 | 11872264 | 14526.1246 |
| 65  | Australia  | Oceania  | 1972 | 71.93000 | 13177000 | 16788.6295 |
| 66  | Australia  | Oceania  | 1977 | 73.49000 | 14074100 | 18334.1975 |
| 67  | Australia  | Oceania  | 1982 | 74.74000 | 15184200 | 19477.0093 |
| 68  | Australia  | Oceania  | 1987 | 76.32000 | 16257249 | 21888.8890 |
| 69  | Australia  | Oceania  | 1992 | 77.56000 | 17481977 | 23424.7668 |
| 70  | Australia  | Oceania  | 1997 | 78.83000 | 18565243 | 26997.9366 |
| 71  | Australia  | Oceania  | 2002 | 80.37000 | 19546792 | 30687.7547 |
| 72  | Australia  | Oceania  | 2007 | 81.23500 | 20434176 | 34435.3674 |
| 73  | Austria    | Europe   | 1952 | 66.80000 | 6927772  | 6137.0765  |
| 74  | Austria    | Europe   | 1957 | 67.48000 | 6965860  | 8842.5980  |
| 75  | Austria    | Europe   | 1962 | 69.54000 | 7129864  | 10750.7211 |
| 76  | Austria    | Europe   | 1967 | 70.14000 | 7376998  | 12834.6024 |
| 77  | Austria    | Europe   | 1972 | 70.63000 | 7544201  | 16661.6256 |
| 78  | Austria    | Europe   | 1977 | 72.17000 | 7568430  | 19749.4223 |
| 79  | Austria    | Europe   | 1982 | 73.18000 | 7574613  | 21597.0836 |
| 80  | Austria    | Europe   | 1987 | 74.94000 | 7578903  | 23687.8261 |
| 81  | Austria    | Europe   | 1992 | 76.04000 | 7914969  | 27042.0187 |
| 82  | Austria    | Europe   | 1997 | 77.51000 | 8069876  | 29095.9207 |
| 83  | Austria    | Europe   | 2002 | 78.98000 | 8148312  | 32417.6077 |
| 84  | Austria    | Europe   | 2007 | 79.82900 | 8199783  | 36126.4927 |
| 85  | Bahrain    | Asia     | 1952 | 50.93900 | 120447   | 9867.0848  |
| 86  | Bahrain    | Asia     | 1957 | 53.83200 | 138655   | 11635.7995 |
| 87  | Bahrain    | Asia     | 1962 | 56.92300 | 171863   | 12753.2751 |
| 88  | Bahrain    | Asia     | 1967 | 59.92300 | 202182   | 14804.6727 |
| 89  | Bahrain    | Asia     | 1972 | 63.30000 | 230800   | 18268.6584 |
| 90  | Bahrain    | Asia     | 1977 | 65.59300 | 297410   | 19340.1020 |
| 91  | Bahrain    | Asia     | 1982 | 69.05200 | 377967   | 19211.1473 |
| 92  | Bahrain    | Asia     | 1987 | 70.75000 | 454612   | 18524.0241 |
| 93  | Bahrain    | Asia     | 1992 | 72.60100 | 529491   | 19035.5792 |
| 94  | Bahrain    | Asia     | 1997 | 73.92500 | 598561   | 20292.0168 |
| 95  | Bahrain    | Asia     | 2002 | 74.79500 | 656397   | 23403.5593 |
| 96  | Bahrain    | Asia     | 2007 | 75.63500 | 708573   | 29796.0483 |
| 97  | Bangladesh | Asia     | 1952 | 37.48400 | 46886859 | 684.2442   |
| 98  | Bangladesh | Asia     | 1957 | 39.34800 | 51365468 | 661.6375   |
| 99  | Bangladesh | Asia     | 1962 | 41.21600 | 56839289 | 686.3416   |
| 100 | Bangladesh | Asia     | 1967 | 43.45300 | 62821884 | 721.1861   |

|     |            |          |      |          |           |            |
|-----|------------|----------|------|----------|-----------|------------|
| 101 | Bangladesh | Asia     | 1972 | 45.25200 | 70759295  | 630.2336   |
| 102 | Bangladesh | Asia     | 1977 | 46.92300 | 80428306  | 659.8772   |
| 103 | Bangladesh | Asia     | 1982 | 50.00900 | 93074406  | 676.9819   |
| 104 | Bangladesh | Asia     | 1987 | 52.81900 | 103764241 | 751.9794   |
| 105 | Bangladesh | Asia     | 1992 | 56.01800 | 113704579 | 837.8102   |
| 106 | Bangladesh | Asia     | 1997 | 59.41200 | 123315288 | 972.7700   |
| 107 | Bangladesh | Asia     | 2002 | 62.01300 | 135656790 | 1136.3904  |
| 108 | Bangladesh | Asia     | 2007 | 64.06200 | 150448339 | 1391.2538  |
| 109 | Belgium    | Europe   | 1952 | 68.00000 | 8730405   | 8343.1051  |
| 110 | Belgium    | Europe   | 1957 | 69.24000 | 8989111   | 9714.9606  |
| 111 | Belgium    | Europe   | 1962 | 70.25000 | 9218400   | 10991.2068 |
| 112 | Belgium    | Europe   | 1967 | 70.94000 | 9556500   | 13149.0412 |
| 113 | Belgium    | Europe   | 1972 | 71.44000 | 9709100   | 16672.1436 |
| 114 | Belgium    | Europe   | 1977 | 72.80000 | 9821800   | 19117.9745 |
| 115 | Belgium    | Europe   | 1982 | 73.93000 | 9856303   | 20979.8459 |
| 116 | Belgium    | Europe   | 1987 | 75.35000 | 9870200   | 22525.5631 |
| 117 | Belgium    | Europe   | 1992 | 76.46000 | 10045622  | 25575.5707 |
| 118 | Belgium    | Europe   | 1997 | 77.53000 | 10199787  | 27561.1966 |
| 119 | Belgium    | Europe   | 2002 | 78.32000 | 10311970  | 30485.8838 |
| 120 | Belgium    | Europe   | 2007 | 79.44100 | 10392226  | 33692.6051 |
| 121 | Benin      | Africa   | 1952 | 38.22300 | 1738315   | 1062.7522  |
| 122 | Benin      | Africa   | 1957 | 40.35800 | 1925173   | 959.6011   |
| 123 | Benin      | Africa   | 1962 | 42.61800 | 2151895   | 949.4991   |
| 124 | Benin      | Africa   | 1967 | 44.88500 | 2427334   | 1035.8314  |
| 125 | Benin      | Africa   | 1972 | 47.01400 | 2761407   | 1085.7969  |
| 126 | Benin      | Africa   | 1977 | 49.19000 | 3168267   | 1029.1613  |
| 127 | Benin      | Africa   | 1982 | 50.90400 | 3641603   | 1277.8976  |
| 128 | Benin      | Africa   | 1987 | 52.33700 | 4243788   | 1225.8560  |
| 129 | Benin      | Africa   | 1992 | 53.91900 | 4981671   | 1191.2077  |
| 130 | Benin      | Africa   | 1997 | 54.77700 | 6066080   | 1232.9753  |
| 131 | Benin      | Africa   | 2002 | 54.40600 | 7026113   | 1372.8779  |
| 132 | Benin      | Africa   | 2007 | 56.72800 | 8078314   | 1441.2849  |
| 133 | Bolivia    | Americas | 1952 | 40.41400 | 2883315   | 2677.3263  |
| 134 | Bolivia    | Americas | 1957 | 41.89000 | 3211738   | 2127.6863  |
| 135 | Bolivia    | Americas | 1962 | 43.42800 | 3593918   | 2180.9725  |
| 136 | Bolivia    | Americas | 1967 | 45.03200 | 4040665   | 2586.8861  |
| 137 | Bolivia    | Americas | 1972 | 46.71400 | 4565872   | 2980.3313  |
| 138 | Bolivia    | Americas | 1977 | 50.02300 | 5079716   | 3548.0978  |
| 139 | Bolivia    | Americas | 1982 | 53.85900 | 5642224   | 3156.5105  |
| 140 | Bolivia    | Americas | 1987 | 57.25100 | 6156369   | 2753.6915  |
| 141 | Bolivia    | Americas | 1992 | 59.95700 | 6893451   | 2961.6997  |
| 142 | Bolivia    | Americas | 1997 | 62.05000 | 7693188   | 3326.1432  |
| 143 | Bolivia    | Americas | 2002 | 63.88300 | 8445134   | 3413.2627  |

|     |                        |          |      |          |           |            |
|-----|------------------------|----------|------|----------|-----------|------------|
| 144 | Bolivia                | Americas | 2007 | 65.55400 | 9119152   | 3822.1371  |
| 145 | Bosnia and Herzegovina | Europe   | 1952 | 53.82000 | 2791000   | 973.5332   |
| 146 | Bosnia and Herzegovina | Europe   | 1957 | 58.45000 | 3076000   | 1353.9892  |
| 147 | Bosnia and Herzegovina | Europe   | 1962 | 61.93000 | 3349000   | 1709.6837  |
| 148 | Bosnia and Herzegovina | Europe   | 1967 | 64.79000 | 3585000   | 2172.3524  |
| 149 | Bosnia and Herzegovina | Europe   | 1972 | 67.45000 | 3819000   | 2860.1698  |
| 150 | Bosnia and Herzegovina | Europe   | 1977 | 69.86000 | 4086000   | 3528.4813  |
| 151 | Bosnia and Herzegovina | Europe   | 1982 | 70.69000 | 4172693   | 4126.6132  |
| 152 | Bosnia and Herzegovina | Europe   | 1987 | 71.14000 | 4338977   | 4314.1148  |
| 153 | Bosnia and Herzegovina | Europe   | 1992 | 72.17800 | 4256013   | 2546.7814  |
| 154 | Bosnia and Herzegovina | Europe   | 1997 | 73.24400 | 3607000   | 4766.3559  |
| 155 | Bosnia and Herzegovina | Europe   | 2002 | 74.09000 | 4165416   | 6018.9752  |
| 156 | Bosnia and Herzegovina | Europe   | 2007 | 74.85200 | 4552198   | 7446.2988  |
| 157 | Botswana               | Africa   | 1952 | 47.62200 | 442308    | 851.2411   |
| 158 | Botswana               | Africa   | 1957 | 49.61800 | 474639    | 918.2325   |
| 159 | Botswana               | Africa   | 1962 | 51.52000 | 512764    | 983.6540   |
| 160 | Botswana               | Africa   | 1967 | 53.29800 | 553541    | 1214.7093  |
| 161 | Botswana               | Africa   | 1972 | 56.02400 | 619351    | 2263.6111  |
| 162 | Botswana               | Africa   | 1977 | 59.31900 | 781472    | 3214.8578  |
| 163 | Botswana               | Africa   | 1982 | 61.48400 | 970347    | 4551.1421  |
| 164 | Botswana               | Africa   | 1987 | 63.62200 | 1151184   | 6205.8839  |
| 165 | Botswana               | Africa   | 1992 | 62.74500 | 1342614   | 7954.1116  |
| 166 | Botswana               | Africa   | 1997 | 52.55600 | 1536536   | 8647.1423  |
| 167 | Botswana               | Africa   | 2002 | 46.63400 | 1630347   | 11003.6051 |
| 168 | Botswana               | Africa   | 2007 | 50.72800 | 1639131   | 12569.8518 |
| 169 | Brazil                 | Americas | 1952 | 50.91700 | 56602560  | 2108.9444  |
| 170 | Brazil                 | Americas | 1957 | 53.28500 | 65551171  | 2487.3660  |
| 171 | Brazil                 | Americas | 1962 | 55.66500 | 76039390  | 3336.5858  |
| 172 | Brazil                 | Americas | 1967 | 57.63200 | 88049823  | 3429.8644  |
| 173 | Brazil                 | Americas | 1972 | 59.50400 | 100840058 | 4985.7115  |
| 174 | Brazil                 | Americas | 1977 | 61.48900 | 114313951 | 6660.1187  |
| 175 | Brazil                 | Americas | 1982 | 63.33600 | 128962939 | 7030.8359  |
| 176 | Brazil                 | Americas | 1987 | 65.20500 | 142938076 | 7807.0958  |
| 177 | Brazil                 | Americas | 1992 | 67.05700 | 155975974 | 6950.2830  |
| 178 | Brazil                 | Americas | 1997 | 69.38800 | 168546719 | 7957.9808  |
| 179 | Brazil                 | Americas | 2002 | 71.00600 | 179914212 | 8131.2128  |
| 180 | Brazil                 | Americas | 2007 | 72.39000 | 190010647 | 9065.8008  |
| 181 | Bulgaria               | Europe   | 1952 | 59.60000 | 7274900   | 2444.2866  |
| 182 | Bulgaria               | Europe   | 1957 | 66.61000 | 7651254   | 3008.6707  |
| 183 | Bulgaria               | Europe   | 1962 | 69.51000 | 8012946   | 4254.3378  |
| 184 | Bulgaria               | Europe   | 1967 | 70.42000 | 8310226   | 5577.0028  |
| 185 | Bulgaria               | Europe   | 1972 | 70.90000 | 8576200   | 6597.4944  |
| 186 | Bulgaria               | Europe   | 1977 | 70.81000 | 8797022   | 7612.2404  |

|     |              |        |      |          |          |            |
|-----|--------------|--------|------|----------|----------|------------|
| 187 | Bulgaria     | Europe | 1982 | 71.08000 | 8892098  | 8224.1916  |
| 188 | Bulgaria     | Europe | 1987 | 71.34000 | 8971958  | 8239.8548  |
| 189 | Bulgaria     | Europe | 1992 | 71.19000 | 8658506  | 6302.6234  |
| 190 | Bulgaria     | Europe | 1997 | 70.32000 | 8066057  | 5970.3888  |
| 191 | Bulgaria     | Europe | 2002 | 72.14000 | 7661799  | 7696.7777  |
| 192 | Bulgaria     | Europe | 2007 | 73.00500 | 7322858  | 10680.7928 |
| 193 | Burkina Faso | Africa | 1952 | 31.97500 | 4469979  | 543.2552   |
| 194 | Burkina Faso | Africa | 1957 | 34.90600 | 4713416  | 617.1835   |
| 195 | Burkina Faso | Africa | 1962 | 37.81400 | 4919632  | 722.5120   |
| 196 | Burkina Faso | Africa | 1967 | 40.69700 | 5127935  | 794.8266   |
| 197 | Burkina Faso | Africa | 1972 | 43.59100 | 5433886  | 854.7360   |
| 198 | Burkina Faso | Africa | 1977 | 46.13700 | 5889574  | 743.3870   |
| 199 | Burkina Faso | Africa | 1982 | 48.12200 | 6634596  | 807.1986   |
| 200 | Burkina Faso | Africa | 1987 | 49.55700 | 7586551  | 912.0631   |
| 201 | Burkina Faso | Africa | 1992 | 50.26000 | 8878303  | 931.7528   |
| 202 | Burkina Faso | Africa | 1997 | 50.32400 | 10352843 | 946.2950   |
| 203 | Burkina Faso | Africa | 2002 | 50.65000 | 12251209 | 1037.6452  |
| 204 | Burkina Faso | Africa | 2007 | 52.29500 | 14326203 | 1217.0330  |
| 205 | Burundi      | Africa | 1952 | 39.03100 | 2445618  | 339.2965   |
| 206 | Burundi      | Africa | 1957 | 40.53300 | 2667518  | 379.5646   |
| 207 | Burundi      | Africa | 1962 | 42.04500 | 2961915  | 355.2032   |
| 208 | Burundi      | Africa | 1967 | 43.54800 | 3330989  | 412.9775   |
| 209 | Burundi      | Africa | 1972 | 44.05700 | 3529983  | 464.0995   |
| 210 | Burundi      | Africa | 1977 | 45.91000 | 3834415  | 556.1033   |
| 211 | Burundi      | Africa | 1982 | 47.47100 | 4580410  | 559.6032   |
| 212 | Burundi      | Africa | 1987 | 48.21100 | 5126023  | 621.8188   |
| 213 | Burundi      | Africa | 1992 | 44.73600 | 5809236  | 631.6999   |
| 214 | Burundi      | Africa | 1997 | 45.32600 | 6121610  | 463.1151   |
| 215 | Burundi      | Africa | 2002 | 47.36000 | 7021078  | 446.4035   |
| 216 | Burundi      | Africa | 2007 | 49.58000 | 8390505  | 430.0707   |
| 217 | Cambodia     | Asia   | 1952 | 39.41700 | 4693836  | 368.4693   |
| 218 | Cambodia     | Asia   | 1957 | 41.36600 | 5322536  | 434.0383   |
| 219 | Cambodia     | Asia   | 1962 | 43.41500 | 6083619  | 496.9136   |
| 220 | Cambodia     | Asia   | 1967 | 45.41500 | 6960067  | 523.4323   |
| 221 | Cambodia     | Asia   | 1972 | 40.31700 | 7450606  | 421.6240   |
| 222 | Cambodia     | Asia   | 1977 | 31.22000 | 6978607  | 524.9722   |
| 223 | Cambodia     | Asia   | 1982 | 50.95700 | 7272485  | 624.4755   |
| 224 | Cambodia     | Asia   | 1987 | 53.91400 | 8371791  | 683.8956   |
| 225 | Cambodia     | Asia   | 1992 | 55.80300 | 10150094 | 682.3032   |
| 226 | Cambodia     | Asia   | 1997 | 56.53400 | 11782962 | 734.2852   |
| 227 | Cambodia     | Asia   | 2002 | 56.75200 | 12926707 | 896.2260   |
| 228 | Cambodia     | Asia   | 2007 | 59.72300 | 14131858 | 1713.7787  |
| 229 | Cameroon     | Africa | 1952 | 38.52300 | 5009067  | 1172.6677  |

|     |                          |          |      |          |          |            |
|-----|--------------------------|----------|------|----------|----------|------------|
| 230 | Cameroon                 | Africa   | 1957 | 40.42800 | 5359923  | 1313.0481  |
| 231 | Cameroon                 | Africa   | 1962 | 42.64300 | 5793633  | 1399.6074  |
| 232 | Cameroon                 | Africa   | 1967 | 44.79900 | 6335506  | 1508.4531  |
| 233 | Cameroon                 | Africa   | 1972 | 47.04900 | 7021028  | 1684.1465  |
| 234 | Cameroon                 | Africa   | 1977 | 49.35500 | 7959865  | 1783.4329  |
| 235 | Cameroon                 | Africa   | 1982 | 52.96100 | 9250831  | 2367.9833  |
| 236 | Cameroon                 | Africa   | 1987 | 54.98500 | 10780667 | 2602.6642  |
| 237 | Cameroon                 | Africa   | 1992 | 54.31400 | 12467171 | 1793.1633  |
| 238 | Cameroon                 | Africa   | 1997 | 52.19900 | 14195809 | 1694.3375  |
| 239 | Cameroon                 | Africa   | 2002 | 49.85600 | 15929988 | 1934.0114  |
| 240 | Cameroon                 | Africa   | 2007 | 50.43000 | 17696293 | 2042.0952  |
| 241 | Canada                   | Americas | 1952 | 68.75000 | 14785584 | 11367.1611 |
| 242 | Canada                   | Americas | 1957 | 69.96000 | 17010154 | 12489.9501 |
| 243 | Canada                   | Americas | 1962 | 71.30000 | 18985849 | 13462.4855 |
| 244 | Canada                   | Americas | 1967 | 72.13000 | 20819767 | 16076.5880 |
| 245 | Canada                   | Americas | 1972 | 72.88000 | 22284500 | 18970.5709 |
| 246 | Canada                   | Americas | 1977 | 74.21000 | 23796400 | 22090.8831 |
| 247 | Canada                   | Americas | 1982 | 75.76000 | 25201900 | 22898.7921 |
| 248 | Canada                   | Americas | 1987 | 76.86000 | 26549700 | 26626.5150 |
| 249 | Canada                   | Americas | 1992 | 77.95000 | 28523502 | 26342.8843 |
| 250 | Canada                   | Americas | 1997 | 78.61000 | 30305843 | 28954.9259 |
| 251 | Canada                   | Americas | 2002 | 79.77000 | 31902268 | 33328.9651 |
| 252 | Canada                   | Americas | 2007 | 80.65300 | 33390141 | 36319.2350 |
| 253 | Central African Republic | Africa   | 1952 | 35.46300 | 1291695  | 1071.3107  |
| 254 | Central African Republic | Africa   | 1957 | 37.46400 | 1392284  | 1190.8443  |
| 255 | Central African Republic | Africa   | 1962 | 39.47500 | 1523478  | 1193.0688  |
| 256 | Central African Republic | Africa   | 1967 | 41.47800 | 1733638  | 1136.0566  |
| 257 | Central African Republic | Africa   | 1972 | 43.45700 | 1927260  | 1070.0133  |
| 258 | Central African Republic | Africa   | 1977 | 46.77500 | 2167533  | 1109.3743  |
| 259 | Central African Republic | Africa   | 1982 | 48.29500 | 2476971  | 956.7530   |
| 260 | Central African Republic | Africa   | 1987 | 50.48500 | 2840009  | 844.8764   |
| 261 | Central African Republic | Africa   | 1992 | 49.39600 | 3265124  | 747.9055   |
| 262 | Central African Republic | Africa   | 1997 | 46.06600 | 3696513  | 740.5063   |
| 263 | Central African Republic | Africa   | 2002 | 43.30800 | 4048013  | 738.6906   |
| 264 | Central African Republic | Africa   | 2007 | 44.74100 | 4369038  | 706.0165   |
| 265 | Chad                     | Africa   | 1952 | 38.09200 | 2682462  | 1178.6659  |
| 266 | Chad                     | Africa   | 1957 | 39.88100 | 2894855  | 1308.4956  |
| 267 | Chad                     | Africa   | 1962 | 41.71600 | 3150417  | 1389.8176  |
| 268 | Chad                     | Africa   | 1967 | 43.60100 | 3495967  | 1196.8106  |
| 269 | Chad                     | Africa   | 1972 | 45.56900 | 3899068  | 1104.1040  |
| 270 | Chad                     | Africa   | 1977 | 47.38300 | 4388260  | 1133.9850  |
| 271 | Chad                     | Africa   | 1982 | 49.51700 | 4875118  | 797.9081   |
| 272 | Chad                     | Africa   | 1987 | 51.05100 | 5498955  | 952.3861   |

|     |          |          |      |          |            |            |
|-----|----------|----------|------|----------|------------|------------|
| 273 | Chad     | Africa   | 1992 | 51.72400 | 6429417    | 1058.0643  |
| 274 | Chad     | Africa   | 1997 | 51.57300 | 7562011    | 1004.9614  |
| 275 | Chad     | Africa   | 2002 | 50.52500 | 8835739    | 1156.1819  |
| 276 | Chad     | Africa   | 2007 | 50.65100 | 10238807   | 1704.0637  |
| 277 | Chile    | Americas | 1952 | 54.74500 | 6377619    | 3939.9788  |
| 278 | Chile    | Americas | 1957 | 56.07400 | 7048426    | 4315.6227  |
| 279 | Chile    | Americas | 1962 | 57.92400 | 7961258    | 4519.0943  |
| 280 | Chile    | Americas | 1967 | 60.52300 | 8858908    | 5106.6543  |
| 281 | Chile    | Americas | 1972 | 63.44100 | 9717524    | 5494.0244  |
| 282 | Chile    | Americas | 1977 | 67.05200 | 10599793   | 4756.7638  |
| 283 | Chile    | Americas | 1982 | 70.56500 | 11487112   | 5095.6657  |
| 284 | Chile    | Americas | 1987 | 72.49200 | 12463354   | 5547.0638  |
| 285 | Chile    | Americas | 1992 | 74.12600 | 13572994   | 7596.1260  |
| 286 | Chile    | Americas | 1997 | 75.81600 | 14599929   | 10118.0532 |
| 287 | Chile    | Americas | 2002 | 77.86000 | 15497046   | 10778.7838 |
| 288 | Chile    | Americas | 2007 | 78.55300 | 16284741   | 13171.6388 |
| 289 | China    | Asia     | 1952 | 44.00000 | 556263527  | 400.4486   |
| 290 | China    | Asia     | 1957 | 50.54896 | 637408000  | 575.9870   |
| 291 | China    | Asia     | 1962 | 44.50136 | 665770000  | 487.6740   |
| 292 | China    | Asia     | 1967 | 58.38112 | 754550000  | 612.7057   |
| 293 | China    | Asia     | 1972 | 63.11888 | 862030000  | 676.9001   |
| 294 | China    | Asia     | 1977 | 63.96736 | 943455000  | 741.2375   |
| 295 | China    | Asia     | 1982 | 65.52500 | 1000281000 | 962.4214   |
| 296 | China    | Asia     | 1987 | 67.27400 | 1084035000 | 1378.9040  |
| 297 | China    | Asia     | 1992 | 68.69000 | 1164970000 | 1655.7842  |
| 298 | China    | Asia     | 1997 | 70.42600 | 1230075000 | 2289.2341  |
| 299 | China    | Asia     | 2002 | 72.02800 | 1280400000 | 3119.2809  |
| 300 | China    | Asia     | 2007 | 72.96100 | 1318683096 | 4959.1149  |
| 301 | Colombia | Americas | 1952 | 50.64300 | 12350771   | 2144.1151  |
| 302 | Colombia | Americas | 1957 | 55.11800 | 14485993   | 2323.8056  |
| 303 | Colombia | Americas | 1962 | 57.86300 | 17009885   | 2492.3511  |
| 304 | Colombia | Americas | 1967 | 59.96300 | 19764027   | 2678.7298  |
| 305 | Colombia | Americas | 1972 | 61.62300 | 22542890   | 3264.6600  |
| 306 | Colombia | Americas | 1977 | 63.83700 | 25094412   | 3815.8079  |
| 307 | Colombia | Americas | 1982 | 66.65300 | 27764644   | 4397.5757  |
| 308 | Colombia | Americas | 1987 | 67.76800 | 30964245   | 4903.2191  |
| 309 | Colombia | Americas | 1992 | 68.42100 | 34202721   | 5444.6486  |
| 310 | Colombia | Americas | 1997 | 70.31300 | 37657830   | 6117.3617  |
| 311 | Colombia | Americas | 2002 | 71.68200 | 41008227   | 5755.2600  |
| 312 | Colombia | Americas | 2007 | 72.88900 | 44227550   | 7006.5804  |
| 313 | Comoros  | Africa   | 1952 | 40.71500 | 153936     | 1102.9909  |
| 314 | Comoros  | Africa   | 1957 | 42.46000 | 170928     | 1211.1485  |
| 315 | Comoros  | Africa   | 1962 | 44.46700 | 191689     | 1406.6483  |

|     |                  |          |      |          |          |           |
|-----|------------------|----------|------|----------|----------|-----------|
| 316 | Comoros          | Africa   | 1967 | 46.47200 | 217378   | 1876.0296 |
| 317 | Comoros          | Africa   | 1972 | 48.94400 | 250027   | 1937.5777 |
| 318 | Comoros          | Africa   | 1977 | 50.93900 | 304739   | 1172.6030 |
| 319 | Comoros          | Africa   | 1982 | 52.93300 | 348643   | 1267.1001 |
| 320 | Comoros          | Africa   | 1987 | 54.92600 | 395114   | 1315.9808 |
| 321 | Comoros          | Africa   | 1992 | 57.93900 | 454429   | 1246.9074 |
| 322 | Comoros          | Africa   | 1997 | 60.66000 | 527982   | 1173.6182 |
| 323 | Comoros          | Africa   | 2002 | 62.97400 | 614382   | 1075.8116 |
| 324 | Comoros          | Africa   | 2007 | 65.15200 | 710960   | 986.1479  |
| 325 | Congo, Dem. Rep. | Africa   | 1952 | 39.14300 | 14100005 | 780.5423  |
| 326 | Congo, Dem. Rep. | Africa   | 1957 | 40.65200 | 15577932 | 905.8602  |
| 327 | Congo, Dem. Rep. | Africa   | 1962 | 42.12200 | 17486434 | 896.3146  |
| 328 | Congo, Dem. Rep. | Africa   | 1967 | 44.05600 | 19941073 | 861.5932  |
| 329 | Congo, Dem. Rep. | Africa   | 1972 | 45.98900 | 23007669 | 904.8961  |
| 330 | Congo, Dem. Rep. | Africa   | 1977 | 47.80400 | 26480870 | 795.7573  |
| 331 | Congo, Dem. Rep. | Africa   | 1982 | 47.78400 | 30646495 | 673.7478  |
| 332 | Congo, Dem. Rep. | Africa   | 1987 | 47.41200 | 35481645 | 672.7748  |
| 333 | Congo, Dem. Rep. | Africa   | 1992 | 45.54800 | 41672143 | 457.7192  |
| 334 | Congo, Dem. Rep. | Africa   | 1997 | 42.58700 | 47798986 | 312.1884  |
| 335 | Congo, Dem. Rep. | Africa   | 2002 | 44.96600 | 55379852 | 241.1659  |
| 336 | Congo, Dem. Rep. | Africa   | 2007 | 46.46200 | 64606759 | 277.5519  |
| 337 | Congo, Rep.      | Africa   | 1952 | 42.11100 | 854885   | 2125.6214 |
| 338 | Congo, Rep.      | Africa   | 1957 | 45.05300 | 940458   | 2315.0566 |
| 339 | Congo, Rep.      | Africa   | 1962 | 48.43500 | 1047924  | 2464.7832 |
| 340 | Congo, Rep.      | Africa   | 1967 | 52.04000 | 1179760  | 2677.9396 |
| 341 | Congo, Rep.      | Africa   | 1972 | 54.90700 | 1340458  | 3213.1527 |
| 342 | Congo, Rep.      | Africa   | 1977 | 55.62500 | 1536769  | 3259.1790 |
| 343 | Congo, Rep.      | Africa   | 1982 | 56.69500 | 1774735  | 4879.5075 |
| 344 | Congo, Rep.      | Africa   | 1987 | 57.47000 | 2064095  | 4201.1949 |
| 345 | Congo, Rep.      | Africa   | 1992 | 56.43300 | 2409073  | 4016.2395 |
| 346 | Congo, Rep.      | Africa   | 1997 | 52.96200 | 2800947  | 3484.1644 |
| 347 | Congo, Rep.      | Africa   | 2002 | 52.97000 | 3328795  | 3484.0620 |
| 348 | Congo, Rep.      | Africa   | 2007 | 55.32200 | 3800610  | 3632.5578 |
| 349 | Costa Rica       | Americas | 1952 | 57.20600 | 926317   | 2627.0095 |
| 350 | Costa Rica       | Americas | 1957 | 60.02600 | 1112300  | 2990.0108 |
| 351 | Costa Rica       | Americas | 1962 | 62.84200 | 1345187  | 3460.9370 |
| 352 | Costa Rica       | Americas | 1967 | 65.42400 | 1588717  | 4161.7278 |
| 353 | Costa Rica       | Americas | 1972 | 67.84900 | 1834796  | 5118.1469 |
| 354 | Costa Rica       | Americas | 1977 | 70.75000 | 2108457  | 5926.8770 |
| 355 | Costa Rica       | Americas | 1982 | 73.45000 | 2424367  | 5262.7348 |
| 356 | Costa Rica       | Americas | 1987 | 74.75200 | 2799811  | 5629.9153 |
| 357 | Costa Rica       | Americas | 1992 | 75.71300 | 3173216  | 6160.4163 |
| 358 | Costa Rica       | Americas | 1997 | 77.26000 | 3518107  | 6677.0453 |

|     |                |          |      |          |          |            |
|-----|----------------|----------|------|----------|----------|------------|
| 359 | Costa Rica     | Americas | 2002 | 78.12300 | 3834934  | 7723.4472  |
| 360 | Costa Rica     | Americas | 2007 | 78.78200 | 4133884  | 9645.0614  |
| 361 | Cote d'Ivoire  | Africa   | 1952 | 40.47700 | 2977019  | 1388.5947  |
| 362 | Cote d'Ivoire  | Africa   | 1957 | 42.46900 | 3300000  | 1500.8959  |
| 363 | Cote d'Ivoire  | Africa   | 1962 | 44.93000 | 3832408  | 1728.8694  |
| 364 | Cote d'Ivoire  | Africa   | 1967 | 47.35000 | 4744870  | 2052.0505  |
| 365 | Cote d'Ivoire  | Africa   | 1972 | 49.80100 | 6071696  | 2378.2011  |
| 366 | Cote d'Ivoire  | Africa   | 1977 | 52.37400 | 7459574  | 2517.7365  |
| 367 | Cote d'Ivoire  | Africa   | 1982 | 53.98300 | 9025951  | 2602.7102  |
| 368 | Cote d'Ivoire  | Africa   | 1987 | 54.65500 | 10761098 | 2156.9561  |
| 369 | Cote d'Ivoire  | Africa   | 1992 | 52.04400 | 12772596 | 1648.0738  |
| 370 | Cote d'Ivoire  | Africa   | 1997 | 47.99100 | 14625967 | 1786.2654  |
| 371 | Cote d'Ivoire  | Africa   | 2002 | 46.83200 | 16252726 | 1648.8008  |
| 372 | Cote d'Ivoire  | Africa   | 2007 | 48.32800 | 18013409 | 1544.7501  |
| 373 | Croatia        | Europe   | 1952 | 61.21000 | 3882229  | 3119.2365  |
| 374 | Croatia        | Europe   | 1957 | 64.77000 | 3991242  | 4338.2316  |
| 375 | Croatia        | Europe   | 1962 | 67.13000 | 4076557  | 5477.8900  |
| 376 | Croatia        | Europe   | 1967 | 68.50000 | 4174366  | 6960.2979  |
| 377 | Croatia        | Europe   | 1972 | 69.61000 | 4225310  | 9164.0901  |
| 378 | Croatia        | Europe   | 1977 | 70.64000 | 4318673  | 11305.3852 |
| 379 | Croatia        | Europe   | 1982 | 70.46000 | 4413368  | 13221.8218 |
| 380 | Croatia        | Europe   | 1987 | 71.52000 | 4484310  | 13822.5839 |
| 381 | Croatia        | Europe   | 1992 | 72.52700 | 4494013  | 8447.7949  |
| 382 | Croatia        | Europe   | 1997 | 73.68000 | 4444595  | 9875.6045  |
| 383 | Croatia        | Europe   | 2002 | 74.87600 | 4481020  | 11628.3890 |
| 384 | Croatia        | Europe   | 2007 | 75.74800 | 4493312  | 14619.2227 |
| 385 | Cuba           | Americas | 1952 | 59.42100 | 6007797  | 5586.5388  |
| 386 | Cuba           | Americas | 1957 | 62.32500 | 6640752  | 6092.1744  |
| 387 | Cuba           | Americas | 1962 | 65.24600 | 7254373  | 5180.7559  |
| 388 | Cuba           | Americas | 1967 | 68.29000 | 8139332  | 5690.2680  |
| 389 | Cuba           | Americas | 1972 | 70.72300 | 8831348  | 5305.4453  |
| 390 | Cuba           | Americas | 1977 | 72.64900 | 9537988  | 6380.4950  |
| 391 | Cuba           | Americas | 1982 | 73.71700 | 9789224  | 7316.9181  |
| 392 | Cuba           | Americas | 1987 | 74.17400 | 10239839 | 7532.9248  |
| 393 | Cuba           | Americas | 1992 | 74.41400 | 10723260 | 5592.8440  |
| 394 | Cuba           | Americas | 1997 | 76.15100 | 10983007 | 5431.9904  |
| 395 | Cuba           | Americas | 2002 | 77.15800 | 11226999 | 6340.6467  |
| 396 | Cuba           | Americas | 2007 | 78.27300 | 11416987 | 8948.1029  |
| 397 | Czech Republic | Europe   | 1952 | 66.87000 | 9125183  | 6876.1403  |
| 398 | Czech Republic | Europe   | 1957 | 69.03000 | 9513758  | 8256.3439  |
| 399 | Czech Republic | Europe   | 1962 | 69.90000 | 9620282  | 10136.8671 |
| 400 | Czech Republic | Europe   | 1967 | 70.38000 | 9835109  | 11399.4449 |
| 401 | Czech Republic | Europe   | 1972 | 70.29000 | 9862158  | 13108.4536 |

|     |                    |          |      |          |          |            |
|-----|--------------------|----------|------|----------|----------|------------|
| 402 | Czech Republic     | Europe   | 1977 | 70.71000 | 10161915 | 14800.1606 |
| 403 | Czech Republic     | Europe   | 1982 | 70.96000 | 10303704 | 15377.2285 |
| 404 | Czech Republic     | Europe   | 1987 | 71.58000 | 10311597 | 16310.4434 |
| 405 | Czech Republic     | Europe   | 1992 | 72.40000 | 10315702 | 14297.0212 |
| 406 | Czech Republic     | Europe   | 1997 | 74.01000 | 10300707 | 16048.5142 |
| 407 | Czech Republic     | Europe   | 2002 | 75.51000 | 10256295 | 17596.2102 |
| 408 | Czech Republic     | Europe   | 2007 | 76.48600 | 10228744 | 22833.3085 |
| 409 | Denmark            | Europe   | 1952 | 70.78000 | 4334000  | 9692.3852  |
| 410 | Denmark            | Europe   | 1957 | 71.81000 | 4487831  | 11099.6593 |
| 411 | Denmark            | Europe   | 1962 | 72.35000 | 4646899  | 13583.3135 |
| 412 | Denmark            | Europe   | 1967 | 72.96000 | 4838800  | 15937.2112 |
| 413 | Denmark            | Europe   | 1972 | 73.47000 | 4991596  | 18866.2072 |
| 414 | Denmark            | Europe   | 1977 | 74.69000 | 5088419  | 20422.9015 |
| 415 | Denmark            | Europe   | 1982 | 74.63000 | 5117810  | 21688.0405 |
| 416 | Denmark            | Europe   | 1987 | 74.80000 | 5127024  | 25116.1758 |
| 417 | Denmark            | Europe   | 1992 | 75.33000 | 5171393  | 26406.7399 |
| 418 | Denmark            | Europe   | 1997 | 76.11000 | 5283663  | 29804.3457 |
| 419 | Denmark            | Europe   | 2002 | 77.18000 | 5374693  | 32166.5001 |
| 420 | Denmark            | Europe   | 2007 | 78.33200 | 5468120  | 35278.4187 |
| 421 | Djibouti           | Africa   | 1952 | 34.81200 | 63149    | 2669.5295  |
| 422 | Djibouti           | Africa   | 1957 | 37.32800 | 71851    | 2864.9691  |
| 423 | Djibouti           | Africa   | 1962 | 39.69300 | 89898    | 3020.9893  |
| 424 | Djibouti           | Africa   | 1967 | 42.07400 | 127617   | 3020.0505  |
| 425 | Djibouti           | Africa   | 1972 | 44.36600 | 178848   | 3694.2124  |
| 426 | Djibouti           | Africa   | 1977 | 46.51900 | 228694   | 3081.7610  |
| 427 | Djibouti           | Africa   | 1982 | 48.81200 | 305991   | 2879.4681  |
| 428 | Djibouti           | Africa   | 1987 | 50.04000 | 311025   | 2880.1026  |
| 429 | Djibouti           | Africa   | 1992 | 51.60400 | 384156   | 2377.1562  |
| 430 | Djibouti           | Africa   | 1997 | 53.15700 | 417908   | 1895.0170  |
| 431 | Djibouti           | Africa   | 2002 | 53.37300 | 447416   | 1908.2609  |
| 432 | Djibouti           | Africa   | 2007 | 54.79100 | 496374   | 2082.4816  |
| 433 | Dominican Republic | Americas | 1952 | 45.92800 | 2491346  | 1397.7171  |
| 434 | Dominican Republic | Americas | 1957 | 49.82800 | 2923186  | 1544.4030  |
| 435 | Dominican Republic | Americas | 1962 | 53.45900 | 3453434  | 1662.1374  |
| 436 | Dominican Republic | Americas | 1967 | 56.75100 | 4049146  | 1653.7230  |
| 437 | Dominican Republic | Americas | 1972 | 59.63100 | 4671329  | 2189.8745  |
| 438 | Dominican Republic | Americas | 1977 | 61.78800 | 5302800  | 2681.9889  |
| 439 | Dominican Republic | Americas | 1982 | 63.72700 | 5968349  | 2861.0924  |
| 440 | Dominican Republic | Americas | 1987 | 66.04600 | 6655297  | 2899.8422  |
| 441 | Dominican Republic | Americas | 1992 | 68.45700 | 7351181  | 3044.2142  |
| 442 | Dominican Republic | Americas | 1997 | 69.95700 | 7992357  | 3614.1013  |
| 443 | Dominican Republic | Americas | 2002 | 70.84700 | 8650322  | 4563.8082  |
| 444 | Dominican Republic | Americas | 2007 | 72.23500 | 9319622  | 6025.3748  |

|     |                   |          |      |          |          |           |
|-----|-------------------|----------|------|----------|----------|-----------|
| 445 | Ecuador           | Americas | 1952 | 48.35700 | 3548753  | 3522.1107 |
| 446 | Ecuador           | Americas | 1957 | 51.35600 | 4058385  | 3780.5467 |
| 447 | Ecuador           | Americas | 1962 | 54.64000 | 4681707  | 4086.1141 |
| 448 | Ecuador           | Americas | 1967 | 56.67800 | 5432424  | 4579.0742 |
| 449 | Ecuador           | Americas | 1972 | 58.79600 | 6298651  | 5280.9947 |
| 450 | Ecuador           | Americas | 1977 | 61.31000 | 7278866  | 6679.6233 |
| 451 | Ecuador           | Americas | 1982 | 64.34200 | 8365850  | 7213.7913 |
| 452 | Ecuador           | Americas | 1987 | 67.23100 | 9545158  | 6481.7770 |
| 453 | Ecuador           | Americas | 1992 | 69.61300 | 10748394 | 7103.7026 |
| 454 | Ecuador           | Americas | 1997 | 72.31200 | 11911819 | 7429.4559 |
| 455 | Ecuador           | Americas | 2002 | 74.17300 | 12921234 | 5773.0445 |
| 456 | Ecuador           | Americas | 2007 | 74.99400 | 13755680 | 6873.2623 |
| 457 | Egypt             | Africa   | 1952 | 41.89300 | 22223309 | 1418.8224 |
| 458 | Egypt             | Africa   | 1957 | 44.44400 | 25009741 | 1458.9153 |
| 459 | Egypt             | Africa   | 1962 | 46.99200 | 28173309 | 1693.3359 |
| 460 | Egypt             | Africa   | 1967 | 49.29300 | 31681188 | 1814.8807 |
| 461 | Egypt             | Africa   | 1972 | 51.13700 | 34807417 | 2024.0081 |
| 462 | Egypt             | Africa   | 1977 | 53.31900 | 38783863 | 2785.4936 |
| 463 | Egypt             | Africa   | 1982 | 56.00600 | 45681811 | 3503.7296 |
| 464 | Egypt             | Africa   | 1987 | 59.79700 | 52799062 | 3885.4607 |
| 465 | Egypt             | Africa   | 1992 | 63.67400 | 59402198 | 3794.7552 |
| 466 | Egypt             | Africa   | 1997 | 67.21700 | 66134291 | 4173.1818 |
| 467 | Egypt             | Africa   | 2002 | 69.80600 | 73312559 | 4754.6044 |
| 468 | Egypt             | Africa   | 2007 | 71.33800 | 80264543 | 5581.1810 |
| 469 | El Salvador       | Americas | 1952 | 45.26200 | 2042865  | 3048.3029 |
| 470 | El Salvador       | Americas | 1957 | 48.57000 | 2355805  | 3421.5232 |
| 471 | El Salvador       | Americas | 1962 | 52.30700 | 2747687  | 3776.8036 |
| 472 | El Salvador       | Americas | 1967 | 55.85500 | 3232927  | 4358.5954 |
| 473 | El Salvador       | Americas | 1972 | 58.20700 | 3790903  | 4520.2460 |
| 474 | El Salvador       | Americas | 1977 | 56.69600 | 4282586  | 5138.9224 |
| 475 | El Salvador       | Americas | 1982 | 56.60400 | 4474873  | 4098.3442 |
| 476 | El Salvador       | Americas | 1987 | 63.15400 | 4842194  | 4140.4421 |
| 477 | El Salvador       | Americas | 1992 | 66.79800 | 5274649  | 4444.2317 |
| 478 | El Salvador       | Americas | 1997 | 69.53500 | 5783439  | 5154.8255 |
| 479 | El Salvador       | Americas | 2002 | 70.73400 | 6353681  | 5351.5687 |
| 480 | El Salvador       | Americas | 2007 | 71.87800 | 6939688  | 5728.3535 |
| 481 | Equatorial Guinea | Africa   | 1952 | 34.48200 | 216964   | 375.6431  |
| 482 | Equatorial Guinea | Africa   | 1957 | 35.98300 | 232922   | 426.0964  |
| 483 | Equatorial Guinea | Africa   | 1962 | 37.48500 | 249220   | 582.8420  |
| 484 | Equatorial Guinea | Africa   | 1967 | 38.98700 | 259864   | 915.5960  |
| 485 | Equatorial Guinea | Africa   | 1972 | 40.51600 | 277603   | 672.4123  |
| 486 | Equatorial Guinea | Africa   | 1977 | 42.02400 | 192675   | 958.5668  |
| 487 | Equatorial Guinea | Africa   | 1982 | 43.66200 | 285483   | 927.8253  |

|     |                   |        |      |          |          |            |
|-----|-------------------|--------|------|----------|----------|------------|
| 488 | Equatorial Guinea | Africa | 1987 | 45.66400 | 341244   | 966.8968   |
| 489 | Equatorial Guinea | Africa | 1992 | 47.54500 | 387838   | 1132.0550  |
| 490 | Equatorial Guinea | Africa | 1997 | 48.24500 | 439971   | 2814.4808  |
| 491 | Equatorial Guinea | Africa | 2002 | 49.34800 | 495627   | 7703.4959  |
| 492 | Equatorial Guinea | Africa | 2007 | 51.57900 | 551201   | 12154.0897 |
| 493 | Eritrea           | Africa | 1952 | 35.92800 | 1438760  | 328.9406   |
| 494 | Eritrea           | Africa | 1957 | 38.04700 | 1542611  | 344.1619   |
| 495 | Eritrea           | Africa | 1962 | 40.15800 | 1666618  | 380.9958   |
| 496 | Eritrea           | Africa | 1967 | 42.18900 | 1820319  | 468.7950   |
| 497 | Eritrea           | Africa | 1972 | 44.14200 | 2260187  | 514.3242   |
| 498 | Eritrea           | Africa | 1977 | 44.53500 | 2512642  | 505.7538   |
| 499 | Eritrea           | Africa | 1982 | 43.89000 | 2637297  | 524.8758   |
| 500 | Eritrea           | Africa | 1987 | 46.45300 | 2915959  | 521.1341   |
| 501 | Eritrea           | Africa | 1992 | 49.99100 | 3668440  | 582.8585   |
| 502 | Eritrea           | Africa | 1997 | 53.37800 | 4058319  | 913.4708   |
| 503 | Eritrea           | Africa | 2002 | 55.24000 | 4414865  | 765.3500   |
| 504 | Eritrea           | Africa | 2007 | 58.04000 | 4906585  | 641.3695   |
| 505 | Ethiopia          | Africa | 1952 | 34.07800 | 20860941 | 362.1463   |
| 506 | Ethiopia          | Africa | 1957 | 36.66700 | 22815614 | 378.9042   |
| 507 | Ethiopia          | Africa | 1962 | 40.05900 | 25145372 | 419.4564   |
| 508 | Ethiopia          | Africa | 1967 | 42.11500 | 27860297 | 516.1186   |
| 509 | Ethiopia          | Africa | 1972 | 43.51500 | 30770372 | 566.2439   |
| 510 | Ethiopia          | Africa | 1977 | 44.51000 | 34617799 | 556.8084   |
| 511 | Ethiopia          | Africa | 1982 | 44.91600 | 38111756 | 577.8607   |
| 512 | Ethiopia          | Africa | 1987 | 46.68400 | 42999530 | 573.7413   |
| 513 | Ethiopia          | Africa | 1992 | 48.09100 | 52088559 | 421.3535   |
| 514 | Ethiopia          | Africa | 1997 | 49.40200 | 59861301 | 515.8894   |
| 515 | Ethiopia          | Africa | 2002 | 50.72500 | 67946797 | 530.0535   |
| 516 | Ethiopia          | Africa | 2007 | 52.94700 | 76511887 | 690.8056   |
| 517 | Finland           | Europe | 1952 | 66.55000 | 4090500  | 6424.5191  |
| 518 | Finland           | Europe | 1957 | 67.49000 | 4324000  | 7545.4154  |
| 519 | Finland           | Europe | 1962 | 68.75000 | 4491443  | 9371.8426  |
| 520 | Finland           | Europe | 1967 | 69.83000 | 4605744  | 10921.6363 |
| 521 | Finland           | Europe | 1972 | 70.87000 | 4639657  | 14358.8759 |
| 522 | Finland           | Europe | 1977 | 72.52000 | 4738902  | 15605.4228 |
| 523 | Finland           | Europe | 1982 | 74.55000 | 4826933  | 18533.1576 |
| 524 | Finland           | Europe | 1987 | 74.83000 | 4931729  | 21141.0122 |
| 525 | Finland           | Europe | 1992 | 75.70000 | 5041039  | 20647.1650 |
| 526 | Finland           | Europe | 1997 | 77.13000 | 5134406  | 23723.9502 |
| 527 | Finland           | Europe | 2002 | 78.37000 | 5193039  | 28204.5906 |
| 528 | Finland           | Europe | 2007 | 79.31300 | 5238460  | 33207.0844 |
| 529 | France            | Europe | 1952 | 67.41000 | 42459667 | 7029.8093  |
| 530 | France            | Europe | 1957 | 68.93000 | 44310863 | 8662.8349  |

|     |         |        |      |          |          |            |
|-----|---------|--------|------|----------|----------|------------|
| 531 | France  | Europe | 1962 | 70.51000 | 47124000 | 10560.4855 |
| 532 | France  | Europe | 1967 | 71.55000 | 49569000 | 12999.9177 |
| 533 | France  | Europe | 1972 | 72.38000 | 51732000 | 16107.1917 |
| 534 | France  | Europe | 1977 | 73.83000 | 53165019 | 18292.6351 |
| 535 | France  | Europe | 1982 | 74.89000 | 54433565 | 20293.8975 |
| 536 | France  | Europe | 1987 | 76.34000 | 55630100 | 22066.4421 |
| 537 | France  | Europe | 1992 | 77.46000 | 57374179 | 24703.7961 |
| 538 | France  | Europe | 1997 | 78.64000 | 58623428 | 25889.7849 |
| 539 | France  | Europe | 2002 | 79.59000 | 59925035 | 28926.0323 |
| 540 | France  | Europe | 2007 | 80.65700 | 61083916 | 30470.0167 |
| 541 | Gabon   | Africa | 1952 | 37.00300 | 420702   | 4293.4765  |
| 542 | Gabon   | Africa | 1957 | 38.99900 | 434904   | 4976.1981  |
| 543 | Gabon   | Africa | 1962 | 40.48900 | 455661   | 6631.4592  |
| 544 | Gabon   | Africa | 1967 | 44.59800 | 489004   | 8358.7620  |
| 545 | Gabon   | Africa | 1972 | 48.69000 | 537977   | 11401.9484 |
| 546 | Gabon   | Africa | 1977 | 52.79000 | 706367   | 21745.5733 |
| 547 | Gabon   | Africa | 1982 | 56.56400 | 753874   | 15113.3619 |
| 548 | Gabon   | Africa | 1987 | 60.19000 | 880397   | 11864.4084 |
| 549 | Gabon   | Africa | 1992 | 61.36600 | 985739   | 13522.1575 |
| 550 | Gabon   | Africa | 1997 | 60.46100 | 1126189  | 14722.8419 |
| 551 | Gabon   | Africa | 2002 | 56.76100 | 1299304  | 12521.7139 |
| 552 | Gabon   | Africa | 2007 | 56.73500 | 1454867  | 13206.4845 |
| 553 | Gambia  | Africa | 1952 | 30.00000 | 284320   | 485.2307   |
| 554 | Gambia  | Africa | 1957 | 32.06500 | 323150   | 520.9267   |
| 555 | Gambia  | Africa | 1962 | 33.89600 | 374020   | 599.6503   |
| 556 | Gambia  | Africa | 1967 | 35.85700 | 439593   | 734.7829   |
| 557 | Gambia  | Africa | 1972 | 38.30800 | 517101   | 756.0868   |
| 558 | Gambia  | Africa | 1977 | 41.84200 | 608274   | 884.7553   |
| 559 | Gambia  | Africa | 1982 | 45.58000 | 715523   | 835.8096   |
| 560 | Gambia  | Africa | 1987 | 49.26500 | 848406   | 611.6589   |
| 561 | Gambia  | Africa | 1992 | 52.64400 | 1025384  | 665.6244   |
| 562 | Gambia  | Africa | 1997 | 55.86100 | 1235767  | 653.7302   |
| 563 | Gambia  | Africa | 2002 | 58.04100 | 1457766  | 660.5856   |
| 564 | Gambia  | Africa | 2007 | 59.44800 | 1688359  | 752.7497   |
| 565 | Germany | Europe | 1952 | 67.50000 | 69145952 | 7144.1144  |
| 566 | Germany | Europe | 1957 | 69.10000 | 71019069 | 10187.8267 |
| 567 | Germany | Europe | 1962 | 70.30000 | 73739117 | 12902.4629 |
| 568 | Germany | Europe | 1967 | 70.80000 | 76368453 | 14745.6256 |
| 569 | Germany | Europe | 1972 | 71.00000 | 78717088 | 18016.1803 |
| 570 | Germany | Europe | 1977 | 72.50000 | 78160773 | 20512.9212 |
| 571 | Germany | Europe | 1982 | 73.80000 | 78335266 | 22031.5327 |
| 572 | Germany | Europe | 1987 | 74.84700 | 77718298 | 24639.1857 |
| 573 | Germany | Europe | 1992 | 76.07000 | 80597764 | 26505.3032 |

|     |           |          |      |          |          |            |
|-----|-----------|----------|------|----------|----------|------------|
| 574 | Germany   | Europe   | 1997 | 77.34000 | 82011073 | 27788.8842 |
| 575 | Germany   | Europe   | 2002 | 78.67000 | 82350671 | 30035.8020 |
| 576 | Germany   | Europe   | 2007 | 79.40600 | 82400996 | 32170.3744 |
| 577 | Ghana     | Africa   | 1952 | 43.14900 | 5581001  | 911.2989   |
| 578 | Ghana     | Africa   | 1957 | 44.77900 | 6391288  | 1043.5615  |
| 579 | Ghana     | Africa   | 1962 | 46.45200 | 7355248  | 1190.0411  |
| 580 | Ghana     | Africa   | 1967 | 48.07200 | 8490213  | 1125.6972  |
| 581 | Ghana     | Africa   | 1972 | 49.87500 | 9354120  | 1178.2237  |
| 582 | Ghana     | Africa   | 1977 | 51.75600 | 10538093 | 993.2240   |
| 583 | Ghana     | Africa   | 1982 | 53.74400 | 11400338 | 876.0326   |
| 584 | Ghana     | Africa   | 1987 | 55.72900 | 14168101 | 847.0061   |
| 585 | Ghana     | Africa   | 1992 | 57.50100 | 16278738 | 925.0602   |
| 586 | Ghana     | Africa   | 1997 | 58.55600 | 18418288 | 1005.2458  |
| 587 | Ghana     | Africa   | 2002 | 58.45300 | 20550751 | 1111.9846  |
| 588 | Ghana     | Africa   | 2007 | 60.02200 | 22873338 | 1327.6089  |
| 589 | Greece    | Europe   | 1952 | 65.86000 | 7733250  | 3530.6901  |
| 590 | Greece    | Europe   | 1957 | 67.86000 | 8096218  | 4916.2999  |
| 591 | Greece    | Europe   | 1962 | 69.51000 | 8448233  | 6017.1907  |
| 592 | Greece    | Europe   | 1967 | 71.00000 | 8716441  | 8513.0970  |
| 593 | Greece    | Europe   | 1972 | 72.34000 | 8888628  | 12724.8296 |
| 594 | Greece    | Europe   | 1977 | 73.68000 | 9308479  | 14195.5243 |
| 595 | Greece    | Europe   | 1982 | 75.24000 | 9786480  | 15268.4209 |
| 596 | Greece    | Europe   | 1987 | 76.67000 | 9974490  | 16120.5284 |
| 597 | Greece    | Europe   | 1992 | 77.03000 | 10325429 | 17541.4963 |
| 598 | Greece    | Europe   | 1997 | 77.86900 | 10502372 | 18747.6981 |
| 599 | Greece    | Europe   | 2002 | 78.25600 | 10603863 | 22514.2548 |
| 600 | Greece    | Europe   | 2007 | 79.48300 | 10706290 | 27538.4119 |
| 601 | Guatemala | Americas | 1952 | 42.02300 | 3146381  | 2428.2378  |
| 602 | Guatemala | Americas | 1957 | 44.14200 | 3640876  | 2617.1560  |
| 603 | Guatemala | Americas | 1962 | 46.95400 | 4208858  | 2750.3644  |
| 604 | Guatemala | Americas | 1967 | 50.01600 | 4690773  | 3242.5311  |
| 605 | Guatemala | Americas | 1972 | 53.73800 | 5149581  | 4031.4083  |
| 606 | Guatemala | Americas | 1977 | 56.02900 | 5703430  | 4879.9927  |
| 607 | Guatemala | Americas | 1982 | 58.13700 | 6395630  | 4820.4948  |
| 608 | Guatemala | Americas | 1987 | 60.78200 | 7326406  | 4246.4860  |
| 609 | Guatemala | Americas | 1992 | 63.37300 | 8486949  | 4439.4508  |
| 610 | Guatemala | Americas | 1997 | 66.32200 | 9803875  | 4684.3138  |
| 611 | Guatemala | Americas | 2002 | 68.97800 | 11178650 | 4858.3475  |
| 612 | Guatemala | Americas | 2007 | 70.25900 | 12572928 | 5186.0500  |
| 613 | Guinea    | Africa   | 1952 | 33.60900 | 2664249  | 510.1965   |
| 614 | Guinea    | Africa   | 1957 | 34.55800 | 2876726  | 576.2670   |
| 615 | Guinea    | Africa   | 1962 | 35.75300 | 3140003  | 686.3737   |
| 616 | Guinea    | Africa   | 1967 | 37.19700 | 3451418  | 708.7595   |

|     |               |          |      |          |         |           |
|-----|---------------|----------|------|----------|---------|-----------|
| 617 | Guinea        | Africa   | 1972 | 38.84200 | 3811387 | 741.6662  |
| 618 | Guinea        | Africa   | 1977 | 40.76200 | 4227026 | 874.6859  |
| 619 | Guinea        | Africa   | 1982 | 42.89100 | 4710497 | 857.2504  |
| 620 | Guinea        | Africa   | 1987 | 45.55200 | 5650262 | 805.5725  |
| 621 | Guinea        | Africa   | 1992 | 48.57600 | 6990574 | 794.3484  |
| 622 | Guinea        | Africa   | 1997 | 51.45500 | 8048834 | 869.4498  |
| 623 | Guinea        | Africa   | 2002 | 53.67600 | 8807818 | 945.5836  |
| 624 | Guinea        | Africa   | 2007 | 56.00700 | 9947814 | 942.6542  |
| 625 | Guinea-Bissau | Africa   | 1952 | 32.50000 | 580653  | 299.8503  |
| 626 | Guinea-Bissau | Africa   | 1957 | 33.48900 | 601095  | 431.7905  |
| 627 | Guinea-Bissau | Africa   | 1962 | 34.48800 | 627820  | 522.0344  |
| 628 | Guinea-Bissau | Africa   | 1967 | 35.49200 | 601287  | 715.5806  |
| 629 | Guinea-Bissau | Africa   | 1972 | 36.48600 | 625361  | 820.2246  |
| 630 | Guinea-Bissau | Africa   | 1977 | 37.46500 | 745228  | 764.7260  |
| 631 | Guinea-Bissau | Africa   | 1982 | 39.32700 | 825987  | 838.1240  |
| 632 | Guinea-Bissau | Africa   | 1987 | 41.24500 | 927524  | 736.4154  |
| 633 | Guinea-Bissau | Africa   | 1992 | 43.26600 | 1050938 | 745.5399  |
| 634 | Guinea-Bissau | Africa   | 1997 | 44.87300 | 1193708 | 796.6645  |
| 635 | Guinea-Bissau | Africa   | 2002 | 45.50400 | 1332459 | 575.7047  |
| 636 | Guinea-Bissau | Africa   | 2007 | 46.38800 | 1472041 | 579.2317  |
| 637 | Haiti         | Americas | 1952 | 37.57900 | 3201488 | 1840.3669 |
| 638 | Haiti         | Americas | 1957 | 40.69600 | 3507701 | 1726.8879 |
| 639 | Haiti         | Americas | 1962 | 43.59000 | 3880130 | 1796.5890 |
| 640 | Haiti         | Americas | 1967 | 46.24300 | 4318137 | 1452.0577 |
| 641 | Haiti         | Americas | 1972 | 48.04200 | 4698301 | 1654.4569 |
| 642 | Haiti         | Americas | 1977 | 49.92300 | 4908554 | 1874.2989 |
| 643 | Haiti         | Americas | 1982 | 51.46100 | 5198399 | 2011.1595 |
| 644 | Haiti         | Americas | 1987 | 53.63600 | 5756203 | 1823.0160 |
| 645 | Haiti         | Americas | 1992 | 55.08900 | 6326682 | 1456.3095 |
| 646 | Haiti         | Americas | 1997 | 56.67100 | 6913545 | 1341.7269 |
| 647 | Haiti         | Americas | 2002 | 58.13700 | 7607651 | 1270.3649 |
| 648 | Haiti         | Americas | 2007 | 60.91600 | 8502814 | 1201.6372 |
| 649 | Honduras      | Americas | 1952 | 41.91200 | 1517453 | 2194.9262 |
| 650 | Honduras      | Americas | 1957 | 44.66500 | 1770390 | 2220.4877 |
| 651 | Honduras      | Americas | 1962 | 48.04100 | 2090162 | 2291.1568 |
| 652 | Honduras      | Americas | 1967 | 50.92400 | 2500689 | 2538.2694 |
| 653 | Honduras      | Americas | 1972 | 53.88400 | 2965146 | 2529.8423 |
| 654 | Honduras      | Americas | 1977 | 57.40200 | 3055235 | 3203.2081 |
| 655 | Honduras      | Americas | 1982 | 60.90900 | 3669448 | 3121.7608 |
| 656 | Honduras      | Americas | 1987 | 64.49200 | 4372203 | 3023.0967 |
| 657 | Honduras      | Americas | 1992 | 66.39900 | 5077347 | 3081.6946 |
| 658 | Honduras      | Americas | 1997 | 67.65900 | 5867957 | 3160.4549 |
| 659 | Honduras      | Americas | 2002 | 68.56500 | 6677328 | 3099.7287 |

|     |                  |          |      |          |           |            |
|-----|------------------|----------|------|----------|-----------|------------|
| 660 | Honduras         | Americas | 2007 | 70.19800 | 7483763   | 3548.3308  |
| 661 | Hong Kong, China | Asia     | 1952 | 60.96000 | 2125900   | 3054.4212  |
| 662 | Hong Kong, China | Asia     | 1957 | 64.75000 | 2736300   | 3629.0765  |
| 663 | Hong Kong, China | Asia     | 1962 | 67.65000 | 3305200   | 4692.6483  |
| 664 | Hong Kong, China | Asia     | 1967 | 70.00000 | 3722800   | 6197.9628  |
| 665 | Hong Kong, China | Asia     | 1972 | 72.00000 | 4115700   | 8315.9281  |
| 666 | Hong Kong, China | Asia     | 1977 | 73.60000 | 4583700   | 11186.1413 |
| 667 | Hong Kong, China | Asia     | 1982 | 75.45000 | 5264500   | 14560.5305 |
| 668 | Hong Kong, China | Asia     | 1987 | 76.20000 | 5584510   | 20038.4727 |
| 669 | Hong Kong, China | Asia     | 1992 | 77.60100 | 5829696   | 24757.6030 |
| 670 | Hong Kong, China | Asia     | 1997 | 80.00000 | 6495918   | 28377.6322 |
| 671 | Hong Kong, China | Asia     | 2002 | 81.49500 | 6762476   | 30209.0152 |
| 672 | Hong Kong, China | Asia     | 2007 | 82.20800 | 6980412   | 39724.9787 |
| 673 | Hungary          | Europe   | 1952 | 64.03000 | 9504000   | 5263.6738  |
| 674 | Hungary          | Europe   | 1957 | 66.41000 | 9839000   | 6040.1800  |
| 675 | Hungary          | Europe   | 1962 | 67.96000 | 10063000  | 7550.3599  |
| 676 | Hungary          | Europe   | 1967 | 69.50000 | 10223422  | 9326.6447  |
| 677 | Hungary          | Europe   | 1972 | 69.76000 | 10394091  | 10168.6561 |
| 678 | Hungary          | Europe   | 1977 | 69.95000 | 10637171  | 11674.8374 |
| 679 | Hungary          | Europe   | 1982 | 69.39000 | 10705535  | 12545.9907 |
| 680 | Hungary          | Europe   | 1987 | 69.58000 | 10612740  | 12986.4800 |
| 681 | Hungary          | Europe   | 1992 | 69.17000 | 10348684  | 10535.6285 |
| 682 | Hungary          | Europe   | 1997 | 71.04000 | 10244684  | 11712.7768 |
| 683 | Hungary          | Europe   | 2002 | 72.59000 | 10083313  | 14843.9356 |
| 684 | Hungary          | Europe   | 2007 | 73.33800 | 9956108   | 18008.9444 |
| 685 | Iceland          | Europe   | 1952 | 72.49000 | 147962    | 7267.6884  |
| 686 | Iceland          | Europe   | 1957 | 73.47000 | 165110    | 9244.0014  |
| 687 | Iceland          | Europe   | 1962 | 73.68000 | 182053    | 10350.1591 |
| 688 | Iceland          | Europe   | 1967 | 73.73000 | 198676    | 13319.8957 |
| 689 | Iceland          | Europe   | 1972 | 74.46000 | 209275    | 15798.0636 |
| 690 | Iceland          | Europe   | 1977 | 76.11000 | 221823    | 19654.9625 |
| 691 | Iceland          | Europe   | 1982 | 76.99000 | 233997    | 23269.6075 |
| 692 | Iceland          | Europe   | 1987 | 77.23000 | 244676    | 26923.2063 |
| 693 | Iceland          | Europe   | 1992 | 78.77000 | 259012    | 25144.3920 |
| 694 | Iceland          | Europe   | 1997 | 78.95000 | 271192    | 28061.0997 |
| 695 | Iceland          | Europe   | 2002 | 80.50000 | 288030    | 31163.2020 |
| 696 | Iceland          | Europe   | 2007 | 81.75700 | 301931    | 36180.7892 |
| 697 | India            | Asia     | 1952 | 37.37300 | 372000000 | 546.5657   |
| 698 | India            | Asia     | 1957 | 40.24900 | 409000000 | 590.0620   |
| 699 | India            | Asia     | 1962 | 43.60500 | 454000000 | 658.3472   |
| 700 | India            | Asia     | 1967 | 47.19300 | 506000000 | 700.7706   |
| 701 | India            | Asia     | 1972 | 50.65100 | 567000000 | 724.0325   |
| 702 | India            | Asia     | 1977 | 54.20800 | 634000000 | 813.3373   |

|     |           |        |      |          |            |            |
|-----|-----------|--------|------|----------|------------|------------|
| 703 | India     | Asia   | 1982 | 56.59600 | 708000000  | 855.7235   |
| 704 | India     | Asia   | 1987 | 58.55300 | 788000000  | 976.5127   |
| 705 | India     | Asia   | 1992 | 60.22300 | 872000000  | 1164.4068  |
| 706 | India     | Asia   | 1997 | 61.76500 | 959000000  | 1458.8174  |
| 707 | India     | Asia   | 2002 | 62.87900 | 1034172547 | 1746.7695  |
| 708 | India     | Asia   | 2007 | 64.69800 | 1110396331 | 2452.2104  |
| 709 | Indonesia | Asia   | 1952 | 37.46800 | 82052000   | 749.6817   |
| 710 | Indonesia | Asia   | 1957 | 39.91800 | 90124000   | 858.9003   |
| 711 | Indonesia | Asia   | 1962 | 42.51800 | 99028000   | 849.2898   |
| 712 | Indonesia | Asia   | 1967 | 45.96400 | 109343000  | 762.4318   |
| 713 | Indonesia | Asia   | 1972 | 49.20300 | 121282000  | 1111.1079  |
| 714 | Indonesia | Asia   | 1977 | 52.70200 | 136725000  | 1382.7021  |
| 715 | Indonesia | Asia   | 1982 | 56.15900 | 153343000  | 1516.8730  |
| 716 | Indonesia | Asia   | 1987 | 60.13700 | 169276000  | 1748.3570  |
| 717 | Indonesia | Asia   | 1992 | 62.68100 | 184816000  | 2383.1409  |
| 718 | Indonesia | Asia   | 1997 | 66.04100 | 199278000  | 3119.3356  |
| 719 | Indonesia | Asia   | 2002 | 68.58800 | 211060000  | 2873.9129  |
| 720 | Indonesia | Asia   | 2007 | 70.65000 | 223547000  | 3540.6516  |
| 721 | Iran      | Asia   | 1952 | 44.86900 | 17272000   | 3035.3260  |
| 722 | Iran      | Asia   | 1957 | 47.18100 | 19792000   | 3290.2576  |
| 723 | Iran      | Asia   | 1962 | 49.32500 | 22874000   | 4187.3298  |
| 724 | Iran      | Asia   | 1967 | 52.46900 | 26538000   | 5906.7318  |
| 725 | Iran      | Asia   | 1972 | 55.23400 | 30614000   | 9613.8186  |
| 726 | Iran      | Asia   | 1977 | 57.70200 | 35480679   | 11888.5951 |
| 727 | Iran      | Asia   | 1982 | 59.62000 | 43072751   | 7608.3346  |
| 728 | Iran      | Asia   | 1987 | 63.04000 | 51889696   | 6642.8814  |
| 729 | Iran      | Asia   | 1992 | 65.74200 | 60397973   | 7235.6532  |
| 730 | Iran      | Asia   | 1997 | 68.04200 | 63327987   | 8263.5903  |
| 731 | Iran      | Asia   | 2002 | 69.45100 | 66907826   | 9240.7620  |
| 732 | Iran      | Asia   | 2007 | 70.96400 | 69453570   | 11605.7145 |
| 733 | Iraq      | Asia   | 1952 | 45.32000 | 5441766    | 4129.7661  |
| 734 | Iraq      | Asia   | 1957 | 48.43700 | 6248643    | 6229.3336  |
| 735 | Iraq      | Asia   | 1962 | 51.45700 | 7240260    | 8341.7378  |
| 736 | Iraq      | Asia   | 1967 | 54.45900 | 8519282    | 8931.4598  |
| 737 | Iraq      | Asia   | 1972 | 56.95000 | 10061506   | 9576.0376  |
| 738 | Iraq      | Asia   | 1977 | 60.41300 | 11882916   | 14688.2351 |
| 739 | Iraq      | Asia   | 1982 | 62.03800 | 14173318   | 14517.9071 |
| 740 | Iraq      | Asia   | 1987 | 65.04400 | 16543189   | 11643.5727 |
| 741 | Iraq      | Asia   | 1992 | 59.46100 | 17861905   | 3745.6407  |
| 742 | Iraq      | Asia   | 1997 | 58.81100 | 20775703   | 3076.2398  |
| 743 | Iraq      | Asia   | 2002 | 57.04600 | 24001816   | 4390.7173  |
| 744 | Iraq      | Asia   | 2007 | 59.54500 | 27499638   | 4471.0619  |
| 745 | Ireland   | Europe | 1952 | 66.91000 | 2952156    | 5210.2803  |

|     |         |          |      |          |          |            |
|-----|---------|----------|------|----------|----------|------------|
| 746 | Ireland | Europe   | 1957 | 68.90000 | 2878220  | 5599.0779  |
| 747 | Ireland | Europe   | 1962 | 70.29000 | 2830000  | 6631.5973  |
| 748 | Ireland | Europe   | 1967 | 71.08000 | 2900100  | 7655.5690  |
| 749 | Ireland | Europe   | 1972 | 71.28000 | 3024400  | 9530.7729  |
| 750 | Ireland | Europe   | 1977 | 72.03000 | 3271900  | 11150.9811 |
| 751 | Ireland | Europe   | 1982 | 73.10000 | 3480000  | 12618.3214 |
| 752 | Ireland | Europe   | 1987 | 74.36000 | 3539900  | 13872.8665 |
| 753 | Ireland | Europe   | 1992 | 75.46700 | 3557761  | 17558.8155 |
| 754 | Ireland | Europe   | 1997 | 76.12200 | 3667233  | 24521.9471 |
| 755 | Ireland | Europe   | 2002 | 77.78300 | 3879155  | 34077.0494 |
| 756 | Ireland | Europe   | 2007 | 78.88500 | 4109086  | 40675.9964 |
| 757 | Israel  | Asia     | 1952 | 65.39000 | 1620914  | 4086.5221  |
| 758 | Israel  | Asia     | 1957 | 67.84000 | 1944401  | 5385.2785  |
| 759 | Israel  | Asia     | 1962 | 69.39000 | 2310904  | 7105.6307  |
| 760 | Israel  | Asia     | 1967 | 70.75000 | 2693585  | 8393.7414  |
| 761 | Israel  | Asia     | 1972 | 71.63000 | 3095893  | 12786.9322 |
| 762 | Israel  | Asia     | 1977 | 73.06000 | 3495918  | 13306.6192 |
| 763 | Israel  | Asia     | 1982 | 74.45000 | 3858421  | 15367.0292 |
| 764 | Israel  | Asia     | 1987 | 75.60000 | 4203148  | 17122.4799 |
| 765 | Israel  | Asia     | 1992 | 76.93000 | 4936550  | 18051.5225 |
| 766 | Israel  | Asia     | 1997 | 78.26900 | 5531387  | 20896.6092 |
| 767 | Israel  | Asia     | 2002 | 79.69600 | 6029529  | 21905.5951 |
| 768 | Israel  | Asia     | 2007 | 80.74500 | 6426679  | 25523.2771 |
| 769 | Italy   | Europe   | 1952 | 65.94000 | 47666000 | 4931.4042  |
| 770 | Italy   | Europe   | 1957 | 67.81000 | 49182000 | 6248.6562  |
| 771 | Italy   | Europe   | 1962 | 69.24000 | 50843200 | 8243.5823  |
| 772 | Italy   | Europe   | 1967 | 71.06000 | 52667100 | 10022.4013 |
| 773 | Italy   | Europe   | 1972 | 72.19000 | 54365564 | 12269.2738 |
| 774 | Italy   | Europe   | 1977 | 73.48000 | 56059245 | 14255.9847 |
| 775 | Italy   | Europe   | 1982 | 74.98000 | 56535636 | 16537.4835 |
| 776 | Italy   | Europe   | 1987 | 76.42000 | 56729703 | 19207.2348 |
| 777 | Italy   | Europe   | 1992 | 77.44000 | 56840847 | 22013.6449 |
| 778 | Italy   | Europe   | 1997 | 78.82000 | 57479469 | 24675.0245 |
| 779 | Italy   | Europe   | 2002 | 80.24000 | 57926999 | 27968.0982 |
| 780 | Italy   | Europe   | 2007 | 80.54600 | 58147733 | 28569.7197 |
| 781 | Jamaica | Americas | 1952 | 58.53000 | 1426095  | 2898.5309  |
| 782 | Jamaica | Americas | 1957 | 62.61000 | 1535090  | 4756.5258  |
| 783 | Jamaica | Americas | 1962 | 65.61000 | 1665128  | 5246.1075  |
| 784 | Jamaica | Americas | 1967 | 67.51000 | 1861096  | 6124.7035  |
| 785 | Jamaica | Americas | 1972 | 69.00000 | 1997616  | 7433.8893  |
| 786 | Jamaica | Americas | 1977 | 70.11000 | 2156814  | 6650.1956  |
| 787 | Jamaica | Americas | 1982 | 71.21000 | 2298309  | 6068.0513  |
| 788 | Jamaica | Americas | 1987 | 71.77000 | 2326606  | 6351.2375  |

|     |                  |          |      |          |           |            |
|-----|------------------|----------|------|----------|-----------|------------|
| 789 | Jamaica          | Americas | 1992 | 71.76600 | 2378618   | 7404.9237  |
| 790 | Jamaica          | Americas | 1997 | 72.26200 | 2531311   | 7121.9247  |
| 791 | Jamaica          | Americas | 2002 | 72.04700 | 2664659   | 6994.7749  |
| 792 | Jamaica          | Americas | 2007 | 72.56700 | 2780132   | 7320.8803  |
| 793 | Japan            | Asia     | 1952 | 63.03000 | 86459025  | 3216.9563  |
| 794 | Japan            | Asia     | 1957 | 65.50000 | 91563009  | 4317.6944  |
| 795 | Japan            | Asia     | 1962 | 68.73000 | 95831757  | 6576.6495  |
| 796 | Japan            | Asia     | 1967 | 71.43000 | 100825279 | 9847.7886  |
| 797 | Japan            | Asia     | 1972 | 73.42000 | 107188273 | 14778.7864 |
| 798 | Japan            | Asia     | 1977 | 75.38000 | 113872473 | 16610.3770 |
| 799 | Japan            | Asia     | 1982 | 77.11000 | 118454974 | 19384.1057 |
| 800 | Japan            | Asia     | 1987 | 78.67000 | 122091325 | 22375.9419 |
| 801 | Japan            | Asia     | 1992 | 79.36000 | 124329269 | 26824.8951 |
| 802 | Japan            | Asia     | 1997 | 80.69000 | 125956499 | 28816.5850 |
| 803 | Japan            | Asia     | 2002 | 82.00000 | 127065841 | 28604.5919 |
| 804 | Japan            | Asia     | 2007 | 82.60300 | 127467972 | 31656.0681 |
| 805 | Jordan           | Asia     | 1952 | 43.15800 | 607914    | 1546.9078  |
| 806 | Jordan           | Asia     | 1957 | 45.66900 | 746559    | 1886.0806  |
| 807 | Jordan           | Asia     | 1962 | 48.12600 | 933559    | 2348.0092  |
| 808 | Jordan           | Asia     | 1967 | 51.62900 | 1255058   | 2741.7963  |
| 809 | Jordan           | Asia     | 1972 | 56.52800 | 1613551   | 2110.8563  |
| 810 | Jordan           | Asia     | 1977 | 61.13400 | 1937652   | 2852.3516  |
| 811 | Jordan           | Asia     | 1982 | 63.73900 | 2347031   | 4161.4160  |
| 812 | Jordan           | Asia     | 1987 | 65.86900 | 2820042   | 4448.6799  |
| 813 | Jordan           | Asia     | 1992 | 68.01500 | 3867409   | 3431.5936  |
| 814 | Jordan           | Asia     | 1997 | 69.77200 | 4526235   | 3645.3796  |
| 815 | Jordan           | Asia     | 2002 | 71.26300 | 5307470   | 3844.9172  |
| 816 | Jordan           | Asia     | 2007 | 72.53500 | 6053193   | 4519.4612  |
| 817 | Kenya            | Africa   | 1952 | 42.27000 | 6464046   | 853.5409   |
| 818 | Kenya            | Africa   | 1957 | 44.68600 | 7454779   | 944.4383   |
| 819 | Kenya            | Africa   | 1962 | 47.94900 | 8678557   | 896.9664   |
| 820 | Kenya            | Africa   | 1967 | 50.65400 | 10191512  | 1056.7365  |
| 821 | Kenya            | Africa   | 1972 | 53.55900 | 12044785  | 1222.3600  |
| 822 | Kenya            | Africa   | 1977 | 56.15500 | 14500404  | 1267.6132  |
| 823 | Kenya            | Africa   | 1982 | 58.76600 | 17661452  | 1348.2258  |
| 824 | Kenya            | Africa   | 1987 | 59.33900 | 21198082  | 1361.9369  |
| 825 | Kenya            | Africa   | 1992 | 59.28500 | 25020539  | 1341.9217  |
| 826 | Kenya            | Africa   | 1997 | 54.40700 | 28263827  | 1360.4850  |
| 827 | Kenya            | Africa   | 2002 | 50.99200 | 31386842  | 1287.5147  |
| 828 | Kenya            | Africa   | 2007 | 54.11000 | 35610177  | 1463.2493  |
| 829 | Korea, Dem. Rep. | Asia     | 1952 | 50.05600 | 8865488   | 1088.2778  |
| 830 | Korea, Dem. Rep. | Asia     | 1957 | 54.08100 | 9411381   | 1571.1347  |
| 831 | Korea, Dem. Rep. | Asia     | 1962 | 56.65600 | 10917494  | 1621.6936  |

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|-----|------------------|-----------|----------|----------|-------------|
| 832 | Korea, Dem. Rep. | Asia 1967 | 59.94200 | 12617009 | 2143.5406   |
| 833 | Korea, Dem. Rep. | Asia 1972 | 63.98300 | 14781241 | 3701.6215   |
| 834 | Korea, Dem. Rep. | Asia 1977 | 67.15900 | 16325320 | 4106.3012   |
| 835 | Korea, Dem. Rep. | Asia 1982 | 69.10000 | 17647518 | 4106.5253   |
| 836 | Korea, Dem. Rep. | Asia 1987 | 70.64700 | 19067554 | 4106.4923   |
| 837 | Korea, Dem. Rep. | Asia 1992 | 69.97800 | 20711375 | 3726.0635   |
| 838 | Korea, Dem. Rep. | Asia 1997 | 67.72700 | 21585105 | 1690.7568   |
| 839 | Korea, Dem. Rep. | Asia 2002 | 66.66200 | 22215365 | 1646.7582   |
| 840 | Korea, Dem. Rep. | Asia 2007 | 67.29700 | 23301725 | 1593.0655   |
| 841 | Korea, Rep.      | Asia 1952 | 47.45300 | 20947571 | 1030.5922   |
| 842 | Korea, Rep.      | Asia 1957 | 52.68100 | 22611552 | 1487.5935   |
| 843 | Korea, Rep.      | Asia 1962 | 55.29200 | 26420307 | 1536.3444   |
| 844 | Korea, Rep.      | Asia 1967 | 57.71600 | 30131000 | 2029.2281   |
| 845 | Korea, Rep.      | Asia 1972 | 62.61200 | 33505000 | 3030.8767   |
| 846 | Korea, Rep.      | Asia 1977 | 64.76600 | 36436000 | 4657.2210   |
| 847 | Korea, Rep.      | Asia 1982 | 67.12300 | 39326000 | 5622.9425   |
| 848 | Korea, Rep.      | Asia 1987 | 69.81000 | 41622000 | 8533.0888   |
| 849 | Korea, Rep.      | Asia 1992 | 72.24400 | 43805450 | 12104.2787  |
| 850 | Korea, Rep.      | Asia 1997 | 74.64700 | 46173816 | 15993.5280  |
| 851 | Korea, Rep.      | Asia 2002 | 77.04500 | 47969150 | 19233.9882  |
| 852 | Korea, Rep.      | Asia 2007 | 78.62300 | 49044790 | 23348.1397  |
| 853 | Kuwait           | Asia 1952 | 55.56500 | 160000   | 108382.3529 |
| 854 | Kuwait           | Asia 1957 | 58.03300 | 212846   | 113523.1329 |
| 855 | Kuwait           | Asia 1962 | 60.47000 | 358266   | 95458.1118  |
| 856 | Kuwait           | Asia 1967 | 64.62400 | 575003   | 80894.8833  |
| 857 | Kuwait           | Asia 1972 | 67.71200 | 841934   | 109347.8670 |
| 858 | Kuwait           | Asia 1977 | 69.34300 | 1140357  | 59265.4771  |
| 859 | Kuwait           | Asia 1982 | 71.30900 | 1497494  | 31354.0357  |
| 860 | Kuwait           | Asia 1987 | 74.17400 | 1891487  | 28118.4300  |
| 861 | Kuwait           | Asia 1992 | 75.19000 | 1418095  | 34932.9196  |
| 862 | Kuwait           | Asia 1997 | 76.15600 | 1765345  | 40300.6200  |
| 863 | Kuwait           | Asia 2002 | 76.90400 | 2111561  | 35110.1057  |
| 864 | Kuwait           | Asia 2007 | 77.58800 | 2505559  | 47306.9898  |
| 865 | Lebanon          | Asia 1952 | 55.92800 | 1439529  | 4834.8041   |
| 866 | Lebanon          | Asia 1957 | 59.48900 | 1647412  | 6089.7869   |
| 867 | Lebanon          | Asia 1962 | 62.09400 | 1886848  | 5714.5606   |
| 868 | Lebanon          | Asia 1967 | 63.87000 | 2186894  | 6006.9830   |
| 869 | Lebanon          | Asia 1972 | 65.42100 | 2680018  | 7486.3843   |
| 870 | Lebanon          | Asia 1977 | 66.09900 | 3115787  | 8659.6968   |
| 871 | Lebanon          | Asia 1982 | 66.98300 | 3086876  | 7640.5195   |
| 872 | Lebanon          | Asia 1987 | 67.92600 | 3089353  | 5377.0913   |
| 873 | Lebanon          | Asia 1992 | 69.29200 | 3219994  | 6890.8069   |
| 874 | Lebanon          | Asia 1997 | 70.26500 | 3430388  | 8754.9639   |

|     |            |        |      |          |         |            |
|-----|------------|--------|------|----------|---------|------------|
| 875 | Lebanon    | Asia   | 2002 | 71.02800 | 3677780 | 9313.9388  |
| 876 | Lebanon    | Asia   | 2007 | 71.99300 | 3921278 | 10461.0587 |
| 877 | Lesotho    | Africa | 1952 | 42.13800 | 748747  | 298.8462   |
| 878 | Lesotho    | Africa | 1957 | 45.04700 | 813338  | 335.9971   |
| 879 | Lesotho    | Africa | 1962 | 47.74700 | 893143  | 411.8006   |
| 880 | Lesotho    | Africa | 1967 | 48.49200 | 996380  | 498.6390   |
| 881 | Lesotho    | Africa | 1972 | 49.76700 | 1116779 | 496.5816   |
| 882 | Lesotho    | Africa | 1977 | 52.20800 | 1251524 | 745.3695   |
| 883 | Lesotho    | Africa | 1982 | 55.07800 | 1411807 | 797.2631   |
| 884 | Lesotho    | Africa | 1987 | 57.18000 | 1599200 | 773.9932   |
| 885 | Lesotho    | Africa | 1992 | 59.68500 | 1803195 | 977.4863   |
| 886 | Lesotho    | Africa | 1997 | 55.55800 | 1982823 | 1186.1480  |
| 887 | Lesotho    | Africa | 2002 | 44.59300 | 2046772 | 1275.1846  |
| 888 | Lesotho    | Africa | 2007 | 42.59200 | 2012649 | 1569.3314  |
| 889 | Liberia    | Africa | 1952 | 38.48000 | 863308  | 575.5730   |
| 890 | Liberia    | Africa | 1957 | 39.48600 | 975950  | 620.9700   |
| 891 | Liberia    | Africa | 1962 | 40.50200 | 1112796 | 634.1952   |
| 892 | Liberia    | Africa | 1967 | 41.53600 | 1279406 | 713.6036   |
| 893 | Liberia    | Africa | 1972 | 42.61400 | 1482628 | 803.0055   |
| 894 | Liberia    | Africa | 1977 | 43.76400 | 1703617 | 640.3224   |
| 895 | Liberia    | Africa | 1982 | 44.85200 | 1956875 | 572.1996   |
| 896 | Liberia    | Africa | 1987 | 46.02700 | 2269414 | 506.1139   |
| 897 | Liberia    | Africa | 1992 | 40.80200 | 1912974 | 636.6229   |
| 898 | Liberia    | Africa | 1997 | 42.22100 | 2200725 | 609.1740   |
| 899 | Liberia    | Africa | 2002 | 43.75300 | 2814651 | 531.4824   |
| 900 | Liberia    | Africa | 2007 | 45.67800 | 3193942 | 414.5073   |
| 901 | Libya      | Africa | 1952 | 42.72300 | 1019729 | 2387.5481  |
| 902 | Libya      | Africa | 1957 | 45.28900 | 1201578 | 3448.2844  |
| 903 | Libya      | Africa | 1962 | 47.80800 | 1441863 | 6757.0308  |
| 904 | Libya      | Africa | 1967 | 50.22700 | 1759224 | 18772.7517 |
| 905 | Libya      | Africa | 1972 | 52.77300 | 2183877 | 21011.4972 |
| 906 | Libya      | Africa | 1977 | 57.44200 | 2721783 | 21951.2118 |
| 907 | Libya      | Africa | 1982 | 62.15500 | 3344074 | 17364.2754 |
| 908 | Libya      | Africa | 1987 | 66.23400 | 3799845 | 11770.5898 |
| 909 | Libya      | Africa | 1992 | 68.75500 | 4364501 | 9640.1385  |
| 910 | Libya      | Africa | 1997 | 71.55500 | 4759670 | 9467.4461  |
| 911 | Libya      | Africa | 2002 | 72.73700 | 5368585 | 9534.6775  |
| 912 | Libya      | Africa | 2007 | 73.95200 | 6036914 | 12057.4993 |
| 913 | Madagascar | Africa | 1952 | 36.68100 | 4762912 | 1443.0117  |
| 914 | Madagascar | Africa | 1957 | 38.86500 | 5181679 | 1589.2027  |
| 915 | Madagascar | Africa | 1962 | 40.84800 | 5703324 | 1643.3871  |
| 916 | Madagascar | Africa | 1967 | 42.88100 | 6334556 | 1634.0473  |
| 917 | Madagascar | Africa | 1972 | 44.85100 | 7082430 | 1748.5630  |

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|-----|------------|--------|------|----------|----------|------------|
| 918 | Madagascar | Africa | 1977 | 46.88100 | 8007166  | 1544.2286  |
| 919 | Madagascar | Africa | 1982 | 48.96900 | 9171477  | 1302.8787  |
| 920 | Madagascar | Africa | 1987 | 49.35000 | 10568642 | 1155.4419  |
| 921 | Madagascar | Africa | 1992 | 52.21400 | 12210395 | 1040.6762  |
| 922 | Madagascar | Africa | 1997 | 54.97800 | 14165114 | 986.2959   |
| 923 | Madagascar | Africa | 2002 | 57.28600 | 16473477 | 894.6371   |
| 924 | Madagascar | Africa | 2007 | 59.44300 | 19167654 | 1044.7701  |
| 925 | Malawi     | Africa | 1952 | 36.25600 | 2917802  | 369.1651   |
| 926 | Malawi     | Africa | 1957 | 37.20700 | 3221238  | 416.3698   |
| 927 | Malawi     | Africa | 1962 | 38.41000 | 3628608  | 427.9011   |
| 928 | Malawi     | Africa | 1967 | 39.48700 | 4147252  | 495.5148   |
| 929 | Malawi     | Africa | 1972 | 41.76600 | 4730997  | 584.6220   |
| 930 | Malawi     | Africa | 1977 | 43.76700 | 5637246  | 663.2237   |
| 931 | Malawi     | Africa | 1982 | 45.64200 | 6502825  | 632.8039   |
| 932 | Malawi     | Africa | 1987 | 47.45700 | 7824747  | 635.5174   |
| 933 | Malawi     | Africa | 1992 | 49.42000 | 10014249 | 563.2000   |
| 934 | Malawi     | Africa | 1997 | 47.49500 | 10419991 | 692.2758   |
| 935 | Malawi     | Africa | 2002 | 45.00900 | 11824495 | 665.4231   |
| 936 | Malawi     | Africa | 2007 | 48.30300 | 13327079 | 759.3499   |
| 937 | Malaysia   | Asia   | 1952 | 48.46300 | 6748378  | 1831.1329  |
| 938 | Malaysia   | Asia   | 1957 | 52.10200 | 7739235  | 1810.0670  |
| 939 | Malaysia   | Asia   | 1962 | 55.73700 | 8906385  | 2036.8849  |
| 940 | Malaysia   | Asia   | 1967 | 59.37100 | 10154878 | 2277.7424  |
| 941 | Malaysia   | Asia   | 1972 | 63.01000 | 11441462 | 2849.0948  |
| 942 | Malaysia   | Asia   | 1977 | 65.25600 | 12845381 | 3827.9216  |
| 943 | Malaysia   | Asia   | 1982 | 68.00000 | 14441916 | 4920.3560  |
| 944 | Malaysia   | Asia   | 1987 | 69.50000 | 16331785 | 5249.8027  |
| 945 | Malaysia   | Asia   | 1992 | 70.69300 | 18319502 | 7277.9128  |
| 946 | Malaysia   | Asia   | 1997 | 71.93800 | 20476091 | 10132.9096 |
| 947 | Malaysia   | Asia   | 2002 | 73.04400 | 22662365 | 10206.9779 |
| 948 | Malaysia   | Asia   | 2007 | 74.24100 | 24821286 | 12451.6558 |
| 949 | Mali       | Africa | 1952 | 33.68500 | 3838168  | 452.3370   |
| 950 | Mali       | Africa | 1957 | 35.30700 | 4241884  | 490.3822   |
| 951 | Mali       | Africa | 1962 | 36.93600 | 4690372  | 496.1743   |
| 952 | Mali       | Africa | 1967 | 38.48700 | 5212416  | 545.0099   |
| 953 | Mali       | Africa | 1972 | 39.97700 | 5828158  | 581.3689   |
| 954 | Mali       | Africa | 1977 | 41.71400 | 6491649  | 686.3953   |
| 955 | Mali       | Africa | 1982 | 43.91600 | 6998256  | 618.0141   |
| 956 | Mali       | Africa | 1987 | 46.36400 | 7634008  | 684.1716   |
| 957 | Mali       | Africa | 1992 | 48.38800 | 8416215  | 739.0144   |
| 958 | Mali       | Africa | 1997 | 49.90300 | 9384984  | 790.2580   |
| 959 | Mali       | Africa | 2002 | 51.81800 | 10580176 | 951.4098   |
| 960 | Mali       | Africa | 2007 | 54.46700 | 12031795 | 1042.5816  |

|      |            |          |      |          |           |            |
|------|------------|----------|------|----------|-----------|------------|
| 961  | Mauritania | Africa   | 1952 | 40.54300 | 1022556   | 743.1159   |
| 962  | Mauritania | Africa   | 1957 | 42.33800 | 1076852   | 846.1203   |
| 963  | Mauritania | Africa   | 1962 | 44.24800 | 1146757   | 1055.8960  |
| 964  | Mauritania | Africa   | 1967 | 46.28900 | 1230542   | 1421.1452  |
| 965  | Mauritania | Africa   | 1972 | 48.43700 | 1332786   | 1586.8518  |
| 966  | Mauritania | Africa   | 1977 | 50.85200 | 1456688   | 1497.4922  |
| 967  | Mauritania | Africa   | 1982 | 53.59900 | 1622136   | 1481.1502  |
| 968  | Mauritania | Africa   | 1987 | 56.14500 | 1841240   | 1421.6036  |
| 969  | Mauritania | Africa   | 1992 | 58.33300 | 2119465   | 1361.3698  |
| 970  | Mauritania | Africa   | 1997 | 60.43000 | 2444741   | 1483.1361  |
| 971  | Mauritania | Africa   | 2002 | 62.24700 | 2828858   | 1579.0195  |
| 972  | Mauritania | Africa   | 2007 | 64.16400 | 3270065   | 1803.1515  |
| 973  | Mauritius  | Africa   | 1952 | 50.98600 | 516556    | 1967.9557  |
| 974  | Mauritius  | Africa   | 1957 | 58.08900 | 609816    | 2034.0380  |
| 975  | Mauritius  | Africa   | 1962 | 60.24600 | 701016    | 2529.0675  |
| 976  | Mauritius  | Africa   | 1967 | 61.55700 | 789309    | 2475.3876  |
| 977  | Mauritius  | Africa   | 1972 | 62.94400 | 851334    | 2575.4842  |
| 978  | Mauritius  | Africa   | 1977 | 64.93000 | 913025    | 3710.9830  |
| 979  | Mauritius  | Africa   | 1982 | 66.71100 | 992040    | 3688.0377  |
| 980  | Mauritius  | Africa   | 1987 | 68.74000 | 1042663   | 4783.5869  |
| 981  | Mauritius  | Africa   | 1992 | 69.74500 | 1096202   | 6058.2538  |
| 982  | Mauritius  | Africa   | 1997 | 70.73600 | 1149818   | 7425.7053  |
| 983  | Mauritius  | Africa   | 2002 | 71.95400 | 1200206   | 9021.8159  |
| 984  | Mauritius  | Africa   | 2007 | 72.80100 | 1250882   | 10956.9911 |
| 985  | Mexico     | Americas | 1952 | 50.78900 | 30144317  | 3478.1255  |
| 986  | Mexico     | Americas | 1957 | 55.19000 | 35015548  | 4131.5466  |
| 987  | Mexico     | Americas | 1962 | 58.29900 | 41121485  | 4581.6094  |
| 988  | Mexico     | Americas | 1967 | 60.11000 | 47995559  | 5754.7339  |
| 989  | Mexico     | Americas | 1972 | 62.36100 | 55984294  | 6809.4067  |
| 990  | Mexico     | Americas | 1977 | 65.03200 | 63759976  | 7674.9291  |
| 991  | Mexico     | Americas | 1982 | 67.40500 | 71640904  | 9611.1475  |
| 992  | Mexico     | Americas | 1987 | 69.49800 | 80122492  | 8688.1560  |
| 993  | Mexico     | Americas | 1992 | 71.45500 | 88111030  | 9472.3843  |
| 994  | Mexico     | Americas | 1997 | 73.67000 | 95895146  | 9767.2975  |
| 995  | Mexico     | Americas | 2002 | 74.90200 | 102479927 | 10742.4405 |
| 996  | Mexico     | Americas | 2007 | 76.19500 | 108700891 | 11977.5750 |
| 997  | Mongolia   | Asia     | 1952 | 42.24400 | 800663    | 786.5669   |
| 998  | Mongolia   | Asia     | 1957 | 45.24800 | 882134    | 912.6626   |
| 999  | Mongolia   | Asia     | 1962 | 48.25100 | 1010280   | 1056.3540  |
| 1000 | Mongolia   | Asia     | 1967 | 51.25300 | 1149500   | 1226.0411  |
| 1001 | Mongolia   | Asia     | 1972 | 53.75400 | 1320500   | 1421.7420  |
| 1002 | Mongolia   | Asia     | 1977 | 55.49100 | 1528000   | 1647.5117  |
| 1003 | Mongolia   | Asia     | 1982 | 57.48900 | 1756032   | 2000.6031  |

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|------|------------|--------|------|----------|----------|------------|
| 1004 | Mongolia   | Asia   | 1987 | 60.22200 | 2015133  | 2338.0083  |
| 1005 | Mongolia   | Asia   | 1992 | 61.27100 | 2312802  | 1785.4020  |
| 1006 | Mongolia   | Asia   | 1997 | 63.62500 | 2494803  | 1902.2521  |
| 1007 | Mongolia   | Asia   | 2002 | 65.03300 | 2674234  | 2140.7393  |
| 1008 | Mongolia   | Asia   | 2007 | 66.80300 | 2874127  | 3095.7723  |
| 1009 | Montenegro | Europe | 1952 | 59.16400 | 413834   | 2647.5856  |
| 1010 | Montenegro | Europe | 1957 | 61.44800 | 442829   | 3682.2599  |
| 1011 | Montenegro | Europe | 1962 | 63.72800 | 474528   | 4649.5938  |
| 1012 | Montenegro | Europe | 1967 | 67.17800 | 501035   | 5907.8509  |
| 1013 | Montenegro | Europe | 1972 | 70.63600 | 527678   | 7778.4140  |
| 1014 | Montenegro | Europe | 1977 | 73.06600 | 560073   | 9595.9299  |
| 1015 | Montenegro | Europe | 1982 | 74.10100 | 562548   | 11222.5876 |
| 1016 | Montenegro | Europe | 1987 | 74.86500 | 569473   | 11732.5102 |
| 1017 | Montenegro | Europe | 1992 | 75.43500 | 621621   | 7003.3390  |
| 1018 | Montenegro | Europe | 1997 | 75.44500 | 692651   | 6465.6133  |
| 1019 | Montenegro | Europe | 2002 | 73.98100 | 720230   | 6557.1943  |
| 1020 | Montenegro | Europe | 2007 | 74.54300 | 684736   | 9253.8961  |
| 1021 | Morocco    | Africa | 1952 | 42.87300 | 9939217  | 1688.2036  |
| 1022 | Morocco    | Africa | 1957 | 45.42300 | 11406350 | 1642.0023  |
| 1023 | Morocco    | Africa | 1962 | 47.92400 | 13056604 | 1566.3535  |
| 1024 | Morocco    | Africa | 1967 | 50.33500 | 14770296 | 1711.0448  |
| 1025 | Morocco    | Africa | 1972 | 52.86200 | 16660670 | 1930.1950  |
| 1026 | Morocco    | Africa | 1977 | 55.73000 | 18396941 | 2370.6200  |
| 1027 | Morocco    | Africa | 1982 | 59.65000 | 20198730 | 2702.6204  |
| 1028 | Morocco    | Africa | 1987 | 62.67700 | 22987397 | 2755.0470  |
| 1029 | Morocco    | Africa | 1992 | 65.39300 | 25798239 | 2948.0473  |
| 1030 | Morocco    | Africa | 1997 | 67.66000 | 28529501 | 2982.1019  |
| 1031 | Morocco    | Africa | 2002 | 69.61500 | 31167783 | 3258.4956  |
| 1032 | Morocco    | Africa | 2007 | 71.16400 | 33757175 | 3820.1752  |
| 1033 | Mozambique | Africa | 1952 | 31.28600 | 6446316  | 468.5260   |
| 1034 | Mozambique | Africa | 1957 | 33.77900 | 7038035  | 495.5868   |
| 1035 | Mozambique | Africa | 1962 | 36.16100 | 7788944  | 556.6864   |
| 1036 | Mozambique | Africa | 1967 | 38.11300 | 8680909  | 566.6692   |
| 1037 | Mozambique | Africa | 1972 | 40.32800 | 9809596  | 724.9178   |
| 1038 | Mozambique | Africa | 1977 | 42.49500 | 11127868 | 502.3197   |
| 1039 | Mozambique | Africa | 1982 | 42.79500 | 12587223 | 462.2114   |
| 1040 | Mozambique | Africa | 1987 | 42.86100 | 12891952 | 389.8762   |
| 1041 | Mozambique | Africa | 1992 | 44.28400 | 13160731 | 410.8968   |
| 1042 | Mozambique | Africa | 1997 | 46.34400 | 16603334 | 472.3461   |
| 1043 | Mozambique | Africa | 2002 | 44.02600 | 18473780 | 633.6179   |
| 1044 | Mozambique | Africa | 2007 | 42.08200 | 19951656 | 823.6856   |
| 1045 | Myanmar    | Asia   | 1952 | 36.31900 | 20092996 | 331.0000   |
| 1046 | Myanmar    | Asia   | 1957 | 41.90500 | 21731844 | 350.0000   |

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|------|-------------|--------|------|----------|----------|------------|
| 1047 | Myanmar     | Asia   | 1962 | 45.10800 | 23634436 | 388.0000   |
| 1048 | Myanmar     | Asia   | 1967 | 49.37900 | 25870271 | 349.0000   |
| 1049 | Myanmar     | Asia   | 1972 | 53.07000 | 28466390 | 357.0000   |
| 1050 | Myanmar     | Asia   | 1977 | 56.05900 | 31528087 | 371.0000   |
| 1051 | Myanmar     | Asia   | 1982 | 58.05600 | 34680442 | 424.0000   |
| 1052 | Myanmar     | Asia   | 1987 | 58.33900 | 38028578 | 385.0000   |
| 1053 | Myanmar     | Asia   | 1992 | 59.32000 | 40546538 | 347.0000   |
| 1054 | Myanmar     | Asia   | 1997 | 60.32800 | 43247867 | 415.0000   |
| 1055 | Myanmar     | Asia   | 2002 | 59.90800 | 45598081 | 611.0000   |
| 1056 | Myanmar     | Asia   | 2007 | 62.06900 | 47761980 | 944.0000   |
| 1057 | Namibia     | Africa | 1952 | 41.72500 | 485831   | 2423.7804  |
| 1058 | Namibia     | Africa | 1957 | 45.22600 | 548080   | 2621.4481  |
| 1059 | Namibia     | Africa | 1962 | 48.38600 | 621392   | 3173.2156  |
| 1060 | Namibia     | Africa | 1967 | 51.15900 | 706640   | 3793.6948  |
| 1061 | Namibia     | Africa | 1972 | 53.86700 | 821782   | 3746.0809  |
| 1062 | Namibia     | Africa | 1977 | 56.43700 | 977026   | 3876.4860  |
| 1063 | Namibia     | Africa | 1982 | 58.96800 | 1099010  | 4191.1005  |
| 1064 | Namibia     | Africa | 1987 | 60.83500 | 1278184  | 3693.7313  |
| 1065 | Namibia     | Africa | 1992 | 61.99900 | 1554253  | 3804.5380  |
| 1066 | Namibia     | Africa | 1997 | 58.90900 | 1774766  | 3899.5243  |
| 1067 | Namibia     | Africa | 2002 | 51.47900 | 1972153  | 4072.3248  |
| 1068 | Namibia     | Africa | 2007 | 52.90600 | 2055080  | 4811.0604  |
| 1069 | Nepal       | Asia   | 1952 | 36.15700 | 9182536  | 545.8657   |
| 1070 | Nepal       | Asia   | 1957 | 37.68600 | 9682338  | 597.9364   |
| 1071 | Nepal       | Asia   | 1962 | 39.39300 | 10332057 | 652.3969   |
| 1072 | Nepal       | Asia   | 1967 | 41.47200 | 11261690 | 676.4422   |
| 1073 | Nepal       | Asia   | 1972 | 43.97100 | 12412593 | 674.7881   |
| 1074 | Nepal       | Asia   | 1977 | 46.74800 | 13933198 | 694.1124   |
| 1075 | Nepal       | Asia   | 1982 | 49.59400 | 15796314 | 718.3731   |
| 1076 | Nepal       | Asia   | 1987 | 52.53700 | 17917180 | 775.6325   |
| 1077 | Nepal       | Asia   | 1992 | 55.72700 | 20326209 | 897.7404   |
| 1078 | Nepal       | Asia   | 1997 | 59.42600 | 23001113 | 1010.8921  |
| 1079 | Nepal       | Asia   | 2002 | 61.34000 | 25873917 | 1057.2063  |
| 1080 | Nepal       | Asia   | 2007 | 63.78500 | 28901790 | 1091.3598  |
| 1081 | Netherlands | Europe | 1952 | 72.13000 | 10381988 | 8941.5719  |
| 1082 | Netherlands | Europe | 1957 | 72.99000 | 11026383 | 11276.1934 |
| 1083 | Netherlands | Europe | 1962 | 73.23000 | 11805689 | 12790.8496 |
| 1084 | Netherlands | Europe | 1967 | 73.82000 | 12596822 | 15363.2514 |
| 1085 | Netherlands | Europe | 1972 | 73.75000 | 13329874 | 18794.7457 |
| 1086 | Netherlands | Europe | 1977 | 75.24000 | 13852989 | 21209.0592 |
| 1087 | Netherlands | Europe | 1982 | 76.05000 | 14310401 | 21399.4605 |
| 1088 | Netherlands | Europe | 1987 | 76.83000 | 14665278 | 23651.3236 |
| 1089 | Netherlands | Europe | 1992 | 77.42000 | 15174244 | 26790.9496 |

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|------|-------------|----------|------|----------|----------|------------|
| 1090 | Netherlands | Europe   | 1997 | 78.03000 | 15604464 | 30246.1306 |
| 1091 | Netherlands | Europe   | 2002 | 78.53000 | 16122830 | 33724.7578 |
| 1092 | Netherlands | Europe   | 2007 | 79.76200 | 16570613 | 36797.9333 |
| 1093 | New Zealand | Oceania  | 1952 | 69.39000 | 1994794  | 10556.5757 |
| 1094 | New Zealand | Oceania  | 1957 | 70.26000 | 2229407  | 12247.3953 |
| 1095 | New Zealand | Oceania  | 1962 | 71.24000 | 2488550  | 13175.6780 |
| 1096 | New Zealand | Oceania  | 1967 | 71.52000 | 2728150  | 14463.9189 |
| 1097 | New Zealand | Oceania  | 1972 | 71.89000 | 2929100  | 16046.0373 |
| 1098 | New Zealand | Oceania  | 1977 | 72.22000 | 3164900  | 16233.7177 |
| 1099 | New Zealand | Oceania  | 1982 | 73.84000 | 3210650  | 17632.4104 |
| 1100 | New Zealand | Oceania  | 1987 | 74.32000 | 3317166  | 19007.1913 |
| 1101 | New Zealand | Oceania  | 1992 | 76.33000 | 3437674  | 18363.3249 |
| 1102 | New Zealand | Oceania  | 1997 | 77.55000 | 3676187  | 21050.4138 |
| 1103 | New Zealand | Oceania  | 2002 | 79.11000 | 3908037  | 23189.8014 |
| 1104 | New Zealand | Oceania  | 2007 | 80.20400 | 4115771  | 25185.0091 |
| 1105 | Nicaragua   | Americas | 1952 | 42.31400 | 1165790  | 3112.3639  |
| 1106 | Nicaragua   | Americas | 1957 | 45.43200 | 1358828  | 3457.4159  |
| 1107 | Nicaragua   | Americas | 1962 | 48.63200 | 1590597  | 3634.3644  |
| 1108 | Nicaragua   | Americas | 1967 | 51.88400 | 1865490  | 4643.3935  |
| 1109 | Nicaragua   | Americas | 1972 | 55.15100 | 2182908  | 4688.5933  |
| 1110 | Nicaragua   | Americas | 1977 | 57.47000 | 2554598  | 5486.3711  |
| 1111 | Nicaragua   | Americas | 1982 | 59.29800 | 2979423  | 3470.3382  |
| 1112 | Nicaragua   | Americas | 1987 | 62.00800 | 3344353  | 2955.9844  |
| 1113 | Nicaragua   | Americas | 1992 | 65.84300 | 4017939  | 2170.1517  |
| 1114 | Nicaragua   | Americas | 1997 | 68.42600 | 4609572  | 2253.0230  |
| 1115 | Nicaragua   | Americas | 2002 | 70.83600 | 5146848  | 2474.5488  |
| 1116 | Nicaragua   | Americas | 2007 | 72.89900 | 5675356  | 2749.3210  |
| 1117 | Niger       | Africa   | 1952 | 37.44400 | 3379468  | 761.8794   |
| 1118 | Niger       | Africa   | 1957 | 38.59800 | 3692184  | 835.5234   |
| 1119 | Niger       | Africa   | 1962 | 39.48700 | 4076008  | 997.7661   |
| 1120 | Niger       | Africa   | 1967 | 40.11800 | 4534062  | 1054.3849  |
| 1121 | Niger       | Africa   | 1972 | 40.54600 | 5060262  | 954.2092   |
| 1122 | Niger       | Africa   | 1977 | 41.29100 | 5682086  | 808.8971   |
| 1123 | Niger       | Africa   | 1982 | 42.59800 | 6437188  | 909.7221   |
| 1124 | Niger       | Africa   | 1987 | 44.55500 | 7332638  | 668.3000   |
| 1125 | Niger       | Africa   | 1992 | 47.39100 | 8392818  | 581.1827   |
| 1126 | Niger       | Africa   | 1997 | 51.31300 | 9666252  | 580.3052   |
| 1127 | Niger       | Africa   | 2002 | 54.49600 | 11140655 | 601.0745   |
| 1128 | Niger       | Africa   | 2007 | 56.86700 | 12894865 | 619.6769   |
| 1129 | Nigeria     | Africa   | 1952 | 36.32400 | 33119096 | 1077.2819  |
| 1130 | Nigeria     | Africa   | 1957 | 37.80200 | 37173340 | 1100.5926  |
| 1131 | Nigeria     | Africa   | 1962 | 39.36000 | 41871351 | 1150.9275  |
| 1132 | Nigeria     | Africa   | 1967 | 41.04000 | 47287752 | 1014.5141  |

|      |          |        |      |          |           |            |
|------|----------|--------|------|----------|-----------|------------|
| 1133 | Nigeria  | Africa | 1972 | 42.82100 | 53740085  | 1698.3888  |
| 1134 | Nigeria  | Africa | 1977 | 44.51400 | 62209173  | 1981.9518  |
| 1135 | Nigeria  | Africa | 1982 | 45.82600 | 73039376  | 1576.9738  |
| 1136 | Nigeria  | Africa | 1987 | 46.88600 | 81551520  | 1385.0296  |
| 1137 | Nigeria  | Africa | 1992 | 47.47200 | 93364244  | 1619.8482  |
| 1138 | Nigeria  | Africa | 1997 | 47.46400 | 106207839 | 1624.9413  |
| 1139 | Nigeria  | Africa | 2002 | 46.60800 | 119901274 | 1615.2864  |
| 1140 | Nigeria  | Africa | 2007 | 46.85900 | 135031164 | 2013.9773  |
| 1141 | Norway   | Europe | 1952 | 72.67000 | 3327728   | 10095.4217 |
| 1142 | Norway   | Europe | 1957 | 73.44000 | 3491938   | 11653.9730 |
| 1143 | Norway   | Europe | 1962 | 73.47000 | 3638919   | 13450.4015 |
| 1144 | Norway   | Europe | 1967 | 74.08000 | 3786019   | 16361.8765 |
| 1145 | Norway   | Europe | 1972 | 74.34000 | 3933004   | 18965.0555 |
| 1146 | Norway   | Europe | 1977 | 75.37000 | 4043205   | 23311.3494 |
| 1147 | Norway   | Europe | 1982 | 75.97000 | 4114787   | 26298.6353 |
| 1148 | Norway   | Europe | 1987 | 75.89000 | 4186147   | 31540.9748 |
| 1149 | Norway   | Europe | 1992 | 77.32000 | 4286357   | 33965.6611 |
| 1150 | Norway   | Europe | 1997 | 78.32000 | 4405672   | 41283.1643 |
| 1151 | Norway   | Europe | 2002 | 79.05000 | 4535591   | 44683.9753 |
| 1152 | Norway   | Europe | 2007 | 80.19600 | 4627926   | 49357.1902 |
| 1153 | Oman     | Asia   | 1952 | 37.57800 | 507833    | 1828.2303  |
| 1154 | Oman     | Asia   | 1957 | 40.08000 | 561977    | 2242.7466  |
| 1155 | Oman     | Asia   | 1962 | 43.16500 | 628164    | 2924.6381  |
| 1156 | Oman     | Asia   | 1967 | 46.98800 | 714775    | 4720.9427  |
| 1157 | Oman     | Asia   | 1972 | 52.14300 | 829050    | 10618.0385 |
| 1158 | Oman     | Asia   | 1977 | 57.36700 | 1004533   | 11848.3439 |
| 1159 | Oman     | Asia   | 1982 | 62.72800 | 1301048   | 12954.7910 |
| 1160 | Oman     | Asia   | 1987 | 67.73400 | 1593882   | 18115.2231 |
| 1161 | Oman     | Asia   | 1992 | 71.19700 | 1915208   | 18616.7069 |
| 1162 | Oman     | Asia   | 1997 | 72.49900 | 2283635   | 19702.0558 |
| 1163 | Oman     | Asia   | 2002 | 74.19300 | 2713462   | 19774.8369 |
| 1164 | Oman     | Asia   | 2007 | 75.64000 | 3204897   | 22316.1929 |
| 1165 | Pakistan | Asia   | 1952 | 43.43600 | 41346560  | 684.5971   |
| 1166 | Pakistan | Asia   | 1957 | 45.55700 | 46679944  | 747.0835   |
| 1167 | Pakistan | Asia   | 1962 | 47.67000 | 53100671  | 803.3427   |
| 1168 | Pakistan | Asia   | 1967 | 49.80000 | 60641899  | 942.4083   |
| 1169 | Pakistan | Asia   | 1972 | 51.92900 | 69325921  | 1049.9390  |
| 1170 | Pakistan | Asia   | 1977 | 54.04300 | 78152686  | 1175.9212  |
| 1171 | Pakistan | Asia   | 1982 | 56.15800 | 91462088  | 1443.4298  |
| 1172 | Pakistan | Asia   | 1987 | 58.24500 | 105186881 | 1704.6866  |
| 1173 | Pakistan | Asia   | 1992 | 60.83800 | 120065004 | 1971.8295  |
| 1174 | Pakistan | Asia   | 1997 | 61.81800 | 135564834 | 2049.3505  |
| 1175 | Pakistan | Asia   | 2002 | 63.61000 | 153403524 | 2092.7124  |

|      |             |          |      |          |           |           |
|------|-------------|----------|------|----------|-----------|-----------|
| 1176 | Pakistan    | Asia     | 2007 | 65.48300 | 169270617 | 2605.9476 |
| 1177 | Panama      | Americas | 1952 | 55.19100 | 940080    | 2480.3803 |
| 1178 | Panama      | Americas | 1957 | 59.20100 | 1063506   | 2961.8009 |
| 1179 | Panama      | Americas | 1962 | 61.81700 | 1215725   | 3536.5403 |
| 1180 | Panama      | Americas | 1967 | 64.07100 | 1405486   | 4421.0091 |
| 1181 | Panama      | Americas | 1972 | 66.21600 | 1616384   | 5364.2497 |
| 1182 | Panama      | Americas | 1977 | 68.68100 | 1839782   | 5351.9121 |
| 1183 | Panama      | Americas | 1982 | 70.47200 | 2036305   | 7009.6016 |
| 1184 | Panama      | Americas | 1987 | 71.52300 | 2253639   | 7034.7792 |
| 1185 | Panama      | Americas | 1992 | 72.46200 | 2484997   | 6618.7431 |
| 1186 | Panama      | Americas | 1997 | 73.73800 | 2734531   | 7113.6923 |
| 1187 | Panama      | Americas | 2002 | 74.71200 | 2990875   | 7356.0319 |
| 1188 | Panama      | Americas | 2007 | 75.53700 | 3242173   | 9809.1856 |
| 1189 | Paraguay    | Americas | 1952 | 62.64900 | 1555876   | 1952.3087 |
| 1190 | Paraguay    | Americas | 1957 | 63.19600 | 1770902   | 2046.1547 |
| 1191 | Paraguay    | Americas | 1962 | 64.36100 | 2009813   | 2148.0271 |
| 1192 | Paraguay    | Americas | 1967 | 64.95100 | 2287985   | 2299.3763 |
| 1193 | Paraguay    | Americas | 1972 | 65.81500 | 2614104   | 2523.3380 |
| 1194 | Paraguay    | Americas | 1977 | 66.35300 | 2984494   | 3248.3733 |
| 1195 | Paraguay    | Americas | 1982 | 66.87400 | 3366439   | 4258.5036 |
| 1196 | Paraguay    | Americas | 1987 | 67.37800 | 3886512   | 3998.8757 |
| 1197 | Paraguay    | Americas | 1992 | 68.22500 | 4483945   | 4196.4111 |
| 1198 | Paraguay    | Americas | 1997 | 69.40000 | 5154123   | 4247.4003 |
| 1199 | Paraguay    | Americas | 2002 | 70.75500 | 5884491   | 3783.6742 |
| 1200 | Paraguay    | Americas | 2007 | 71.75200 | 6667147   | 4172.8385 |
| 1201 | Peru        | Americas | 1952 | 43.90200 | 8025700   | 3758.5234 |
| 1202 | Peru        | Americas | 1957 | 46.26300 | 9146100   | 4245.2567 |
| 1203 | Peru        | Americas | 1962 | 49.09600 | 10516500  | 4957.0380 |
| 1204 | Peru        | Americas | 1967 | 51.44500 | 12132200  | 5788.0933 |
| 1205 | Peru        | Americas | 1972 | 55.44800 | 13954700  | 5937.8273 |
| 1206 | Peru        | Americas | 1977 | 58.44700 | 15990099  | 6281.2909 |
| 1207 | Peru        | Americas | 1982 | 61.40600 | 18125129  | 6434.5018 |
| 1208 | Peru        | Americas | 1987 | 64.13400 | 20195924  | 6360.9434 |
| 1209 | Peru        | Americas | 1992 | 66.45800 | 22430449  | 4446.3809 |
| 1210 | Peru        | Americas | 1997 | 68.38600 | 24748122  | 5838.3477 |
| 1211 | Peru        | Americas | 2002 | 69.90600 | 26769436  | 5909.0201 |
| 1212 | Peru        | Americas | 2007 | 71.42100 | 28674757  | 7408.9056 |
| 1213 | Philippines | Asia     | 1952 | 47.75200 | 22438691  | 1272.8810 |
| 1214 | Philippines | Asia     | 1957 | 51.33400 | 26072194  | 1547.9448 |
| 1215 | Philippines | Asia     | 1962 | 54.75700 | 30325264  | 1649.5522 |
| 1216 | Philippines | Asia     | 1967 | 56.39300 | 35356600  | 1814.1274 |
| 1217 | Philippines | Asia     | 1972 | 58.06500 | 40850141  | 1989.3741 |
| 1218 | Philippines | Asia     | 1977 | 60.06000 | 46850962  | 2373.2043 |

|      |             |          |      |          |          |            |
|------|-------------|----------|------|----------|----------|------------|
| 1219 | Philippines | Asia     | 1982 | 62.08200 | 53456774 | 2603.2738  |
| 1220 | Philippines | Asia     | 1987 | 64.15100 | 60017788 | 2189.6350  |
| 1221 | Philippines | Asia     | 1992 | 66.45800 | 67185766 | 2279.3240  |
| 1222 | Philippines | Asia     | 1997 | 68.56400 | 75012988 | 2536.5349  |
| 1223 | Philippines | Asia     | 2002 | 70.30300 | 82995088 | 2650.9211  |
| 1224 | Philippines | Asia     | 2007 | 71.68800 | 91077287 | 3190.4810  |
| 1225 | Poland      | Europe   | 1952 | 61.31000 | 25730551 | 4029.3297  |
| 1226 | Poland      | Europe   | 1957 | 65.77000 | 28235346 | 4734.2530  |
| 1227 | Poland      | Europe   | 1962 | 67.64000 | 30329617 | 5338.7521  |
| 1228 | Poland      | Europe   | 1967 | 69.61000 | 31785378 | 6557.1528  |
| 1229 | Poland      | Europe   | 1972 | 70.85000 | 33039545 | 8006.5070  |
| 1230 | Poland      | Europe   | 1977 | 70.67000 | 34621254 | 9508.1415  |
| 1231 | Poland      | Europe   | 1982 | 71.32000 | 36227381 | 8451.5310  |
| 1232 | Poland      | Europe   | 1987 | 70.98000 | 37740710 | 9082.3512  |
| 1233 | Poland      | Europe   | 1992 | 70.99000 | 38370697 | 7738.8812  |
| 1234 | Poland      | Europe   | 1997 | 72.75000 | 38654957 | 10159.5837 |
| 1235 | Poland      | Europe   | 2002 | 74.67000 | 38625976 | 12002.2391 |
| 1236 | Poland      | Europe   | 2007 | 75.56300 | 38518241 | 15389.9247 |
| 1237 | Portugal    | Europe   | 1952 | 59.82000 | 8526050  | 3068.3199  |
| 1238 | Portugal    | Europe   | 1957 | 61.51000 | 8817650  | 3774.5717  |
| 1239 | Portugal    | Europe   | 1962 | 64.39000 | 9019800  | 4727.9549  |
| 1240 | Portugal    | Europe   | 1967 | 66.60000 | 9103000  | 6361.5180  |
| 1241 | Portugal    | Europe   | 1972 | 69.26000 | 8970450  | 9022.2474  |
| 1242 | Portugal    | Europe   | 1977 | 70.41000 | 9662600  | 10172.4857 |
| 1243 | Portugal    | Europe   | 1982 | 72.77000 | 9859650  | 11753.8429 |
| 1244 | Portugal    | Europe   | 1987 | 74.06000 | 9915289  | 13039.3088 |
| 1245 | Portugal    | Europe   | 1992 | 74.86000 | 9927680  | 16207.2666 |
| 1246 | Portugal    | Europe   | 1997 | 75.97000 | 10156415 | 17641.0316 |
| 1247 | Portugal    | Europe   | 2002 | 77.29000 | 10433867 | 19970.9079 |
| 1248 | Portugal    | Europe   | 2007 | 78.09800 | 10642836 | 20509.6478 |
| 1249 | Puerto Rico | Americas | 1952 | 64.28000 | 2227000  | 3081.9598  |
| 1250 | Puerto Rico | Americas | 1957 | 68.54000 | 2260000  | 3907.1562  |
| 1251 | Puerto Rico | Americas | 1962 | 69.62000 | 2448046  | 5108.3446  |
| 1252 | Puerto Rico | Americas | 1967 | 71.10000 | 2648961  | 6929.2777  |
| 1253 | Puerto Rico | Americas | 1972 | 72.16000 | 2847132  | 9123.0417  |
| 1254 | Puerto Rico | Americas | 1977 | 73.44000 | 3080828  | 9770.5249  |
| 1255 | Puerto Rico | Americas | 1982 | 73.75000 | 3279001  | 10330.9891 |
| 1256 | Puerto Rico | Americas | 1987 | 74.63000 | 3444468  | 12281.3419 |
| 1257 | Puerto Rico | Americas | 1992 | 73.91100 | 3585176  | 14641.5871 |
| 1258 | Puerto Rico | Americas | 1997 | 74.91700 | 3759430  | 16999.4333 |
| 1259 | Puerto Rico | Americas | 2002 | 77.77800 | 3859606  | 18855.6062 |
| 1260 | Puerto Rico | Americas | 2007 | 78.74600 | 3942491  | 19328.7090 |
| 1261 | Reunion     | Africa   | 1952 | 52.72400 | 257700   | 2718.8853  |

|      |                       |        |      |          |          |            |
|------|-----------------------|--------|------|----------|----------|------------|
| 1262 | Reunion               | Africa | 1957 | 55.09000 | 308700   | 2769.4518  |
| 1263 | Reunion               | Africa | 1962 | 57.66600 | 358900   | 3173.7233  |
| 1264 | Reunion               | Africa | 1967 | 60.54200 | 414024   | 4021.1757  |
| 1265 | Reunion               | Africa | 1972 | 64.27400 | 461633   | 5047.6586  |
| 1266 | Reunion               | Africa | 1977 | 67.06400 | 492095   | 4319.8041  |
| 1267 | Reunion               | Africa | 1982 | 69.88500 | 517810   | 5267.2194  |
| 1268 | Reunion               | Africa | 1987 | 71.91300 | 562035   | 5303.3775  |
| 1269 | Reunion               | Africa | 1992 | 73.61500 | 622191   | 6101.2558  |
| 1270 | Reunion               | Africa | 1997 | 74.77200 | 684810   | 6071.9414  |
| 1271 | Reunion               | Africa | 2002 | 75.74400 | 743981   | 6316.1652  |
| 1272 | Reunion               | Africa | 2007 | 76.44200 | 798094   | 7670.1226  |
| 1273 | Romania               | Europe | 1952 | 61.05000 | 16630000 | 3144.6132  |
| 1274 | Romania               | Europe | 1957 | 64.10000 | 17829327 | 3943.3702  |
| 1275 | Romania               | Europe | 1962 | 66.80000 | 18680721 | 4734.9976  |
| 1276 | Romania               | Europe | 1967 | 66.80000 | 19284814 | 6470.8665  |
| 1277 | Romania               | Europe | 1972 | 69.21000 | 20662648 | 8011.4144  |
| 1278 | Romania               | Europe | 1977 | 69.46000 | 21658597 | 9356.3972  |
| 1279 | Romania               | Europe | 1982 | 69.66000 | 22356726 | 9605.3141  |
| 1280 | Romania               | Europe | 1987 | 69.53000 | 22686371 | 9696.2733  |
| 1281 | Romania               | Europe | 1992 | 69.36000 | 22797027 | 6598.4099  |
| 1282 | Romania               | Europe | 1997 | 69.72000 | 22562458 | 7346.5476  |
| 1283 | Romania               | Europe | 2002 | 71.32200 | 22404337 | 7885.3601  |
| 1284 | Romania               | Europe | 2007 | 72.47600 | 22276056 | 10808.4756 |
| 1285 | Rwanda                | Africa | 1952 | 40.00000 | 2534927  | 493.3239   |
| 1286 | Rwanda                | Africa | 1957 | 41.50000 | 2822082  | 540.2894   |
| 1287 | Rwanda                | Africa | 1962 | 43.00000 | 3051242  | 597.4731   |
| 1288 | Rwanda                | Africa | 1967 | 44.10000 | 3451079  | 510.9637   |
| 1289 | Rwanda                | Africa | 1972 | 44.60000 | 3992121  | 590.5807   |
| 1290 | Rwanda                | Africa | 1977 | 45.00000 | 4657072  | 670.0806   |
| 1291 | Rwanda                | Africa | 1982 | 46.21800 | 5507565  | 881.5706   |
| 1292 | Rwanda                | Africa | 1987 | 44.02000 | 6349365  | 847.9912   |
| 1293 | Rwanda                | Africa | 1992 | 23.59900 | 7290203  | 737.0686   |
| 1294 | Rwanda                | Africa | 1997 | 36.08700 | 7212583  | 589.9445   |
| 1295 | Rwanda                | Africa | 2002 | 43.41300 | 7852401  | 785.6538   |
| 1296 | Rwanda                | Africa | 2007 | 46.24200 | 8860588  | 863.0885   |
| 1297 | Sao Tome and Principe | Africa | 1952 | 46.47100 | 60011    | 879.5836   |
| 1298 | Sao Tome and Principe | Africa | 1957 | 48.94500 | 61325    | 860.7369   |
| 1299 | Sao Tome and Principe | Africa | 1962 | 51.89300 | 65345    | 1071.5511  |
| 1300 | Sao Tome and Principe | Africa | 1967 | 54.42500 | 70787    | 1384.8406  |
| 1301 | Sao Tome and Principe | Africa | 1972 | 56.48000 | 76595    | 1532.9853  |
| 1302 | Sao Tome and Principe | Africa | 1977 | 58.55000 | 86796    | 1737.5617  |
| 1303 | Sao Tome and Principe | Africa | 1982 | 60.35100 | 98593    | 1890.2181  |
| 1304 | Sao Tome and Principe | Africa | 1987 | 61.72800 | 110812   | 1516.5255  |

|      |                       |        |      |          |          |            |
|------|-----------------------|--------|------|----------|----------|------------|
| 1305 | Sao Tome and Principe | Africa | 1992 | 62.74200 | 125911   | 1428.7778  |
| 1306 | Sao Tome and Principe | Africa | 1997 | 63.30600 | 145608   | 1339.0760  |
| 1307 | Sao Tome and Principe | Africa | 2002 | 64.33700 | 170372   | 1353.0924  |
| 1308 | Sao Tome and Principe | Africa | 2007 | 65.52800 | 199579   | 1598.4351  |
| 1309 | Saudi Arabia          | Asia   | 1952 | 39.87500 | 4005677  | 6459.5548  |
| 1310 | Saudi Arabia          | Asia   | 1957 | 42.86800 | 4419650  | 8157.5912  |
| 1311 | Saudi Arabia          | Asia   | 1962 | 45.91400 | 4943029  | 11626.4197 |
| 1312 | Saudi Arabia          | Asia   | 1967 | 49.90100 | 5618198  | 16903.0489 |
| 1313 | Saudi Arabia          | Asia   | 1972 | 53.88600 | 6472756  | 24837.4287 |
| 1314 | Saudi Arabia          | Asia   | 1977 | 58.69000 | 8128505  | 34167.7626 |
| 1315 | Saudi Arabia          | Asia   | 1982 | 63.01200 | 11254672 | 33693.1753 |
| 1316 | Saudi Arabia          | Asia   | 1987 | 66.29500 | 14619745 | 21198.2614 |
| 1317 | Saudi Arabia          | Asia   | 1992 | 68.76800 | 16945857 | 24841.6178 |
| 1318 | Saudi Arabia          | Asia   | 1997 | 70.53300 | 21229759 | 20586.6902 |
| 1319 | Saudi Arabia          | Asia   | 2002 | 71.62600 | 24501530 | 19014.5412 |
| 1320 | Saudi Arabia          | Asia   | 2007 | 72.77700 | 27601038 | 21654.8319 |
| 1321 | Senegal               | Africa | 1952 | 37.27800 | 2755589  | 1450.3570  |
| 1322 | Senegal               | Africa | 1957 | 39.32900 | 3054547  | 1567.6530  |
| 1323 | Senegal               | Africa | 1962 | 41.45400 | 3430243  | 1654.9887  |
| 1324 | Senegal               | Africa | 1967 | 43.56300 | 3965841  | 1612.4046  |
| 1325 | Senegal               | Africa | 1972 | 45.81500 | 4588696  | 1597.7121  |
| 1326 | Senegal               | Africa | 1977 | 48.87900 | 5260855  | 1561.7691  |
| 1327 | Senegal               | Africa | 1982 | 52.37900 | 6147783  | 1518.4800  |
| 1328 | Senegal               | Africa | 1987 | 55.76900 | 7171347  | 1441.7207  |
| 1329 | Senegal               | Africa | 1992 | 58.19600 | 8307920  | 1367.8994  |
| 1330 | Senegal               | Africa | 1997 | 60.18700 | 9535314  | 1392.3683  |
| 1331 | Senegal               | Africa | 2002 | 61.60000 | 10870037 | 1519.6353  |
| 1332 | Senegal               | Africa | 2007 | 63.06200 | 12267493 | 1712.4721  |
| 1333 | Serbia                | Europe | 1952 | 57.99600 | 6860147  | 3581.4594  |
| 1334 | Serbia                | Europe | 1957 | 61.68500 | 7271135  | 4981.0909  |
| 1335 | Serbia                | Europe | 1962 | 64.53100 | 7616060  | 6289.6292  |
| 1336 | Serbia                | Europe | 1967 | 66.91400 | 7971222  | 7991.7071  |
| 1337 | Serbia                | Europe | 1972 | 68.70000 | 8313288  | 10522.0675 |
| 1338 | Serbia                | Europe | 1977 | 70.30000 | 8686367  | 12980.6696 |
| 1339 | Serbia                | Europe | 1982 | 70.16200 | 9032824  | 15181.0927 |
| 1340 | Serbia                | Europe | 1987 | 71.21800 | 9230783  | 15870.8785 |
| 1341 | Serbia                | Europe | 1992 | 71.65900 | 9826397  | 9325.0682  |
| 1342 | Serbia                | Europe | 1997 | 72.23200 | 10336594 | 7914.3203  |
| 1343 | Serbia                | Europe | 2002 | 73.21300 | 10111559 | 7236.0753  |
| 1344 | Serbia                | Europe | 2007 | 74.00200 | 10150265 | 9786.5347  |
| 1345 | Sierra Leone          | Africa | 1952 | 30.33100 | 2143249  | 879.7877   |
| 1346 | Sierra Leone          | Africa | 1957 | 31.57000 | 2295678  | 1004.4844  |
| 1347 | Sierra Leone          | Africa | 1962 | 32.76700 | 2467895  | 1116.6399  |

|      |                 |        |      |          |         |            |
|------|-----------------|--------|------|----------|---------|------------|
| 1348 | Sierra Leone    | Africa | 1967 | 34.11300 | 2662190 | 1206.0435  |
| 1349 | Sierra Leone    | Africa | 1972 | 35.40000 | 2879013 | 1353.7598  |
| 1350 | Sierra Leone    | Africa | 1977 | 36.78800 | 3140897 | 1348.2852  |
| 1351 | Sierra Leone    | Africa | 1982 | 38.44500 | 3464522 | 1465.0108  |
| 1352 | Sierra Leone    | Africa | 1987 | 40.00600 | 3868905 | 1294.4478  |
| 1353 | Sierra Leone    | Africa | 1992 | 38.33300 | 4260884 | 1068.6963  |
| 1354 | Sierra Leone    | Africa | 1997 | 39.89700 | 4578212 | 574.6482   |
| 1355 | Sierra Leone    | Africa | 2002 | 41.01200 | 5359092 | 699.4897   |
| 1356 | Sierra Leone    | Africa | 2007 | 42.56800 | 6144562 | 862.5408   |
| 1357 | Singapore       | Asia   | 1952 | 60.39600 | 1127000 | 2315.1382  |
| 1358 | Singapore       | Asia   | 1957 | 63.17900 | 1445929 | 2843.1044  |
| 1359 | Singapore       | Asia   | 1962 | 65.79800 | 1750200 | 3674.7356  |
| 1360 | Singapore       | Asia   | 1967 | 67.94600 | 1977600 | 4977.4185  |
| 1361 | Singapore       | Asia   | 1972 | 69.52100 | 2152400 | 8597.7562  |
| 1362 | Singapore       | Asia   | 1977 | 70.79500 | 2325300 | 11210.0895 |
| 1363 | Singapore       | Asia   | 1982 | 71.76000 | 2651869 | 15169.1611 |
| 1364 | Singapore       | Asia   | 1987 | 73.56000 | 2794552 | 18861.5308 |
| 1365 | Singapore       | Asia   | 1992 | 75.78800 | 3235865 | 24769.8912 |
| 1366 | Singapore       | Asia   | 1997 | 77.15800 | 3802309 | 33519.4766 |
| 1367 | Singapore       | Asia   | 2002 | 78.77000 | 4197776 | 36023.1054 |
| 1368 | Singapore       | Asia   | 2007 | 79.97200 | 4553009 | 47143.1796 |
| 1369 | Slovak Republic | Europe | 1952 | 64.36000 | 3558137 | 5074.6591  |
| 1370 | Slovak Republic | Europe | 1957 | 67.45000 | 3844277 | 6093.2630  |
| 1371 | Slovak Republic | Europe | 1962 | 70.33000 | 4237384 | 7481.1076  |
| 1372 | Slovak Republic | Europe | 1967 | 70.98000 | 4442238 | 8412.9024  |
| 1373 | Slovak Republic | Europe | 1972 | 70.35000 | 4593433 | 9674.1676  |
| 1374 | Slovak Republic | Europe | 1977 | 70.45000 | 4827803 | 10922.6640 |
| 1375 | Slovak Republic | Europe | 1982 | 70.80000 | 5048043 | 11348.5459 |
| 1376 | Slovak Republic | Europe | 1987 | 71.08000 | 5199318 | 12037.2676 |
| 1377 | Slovak Republic | Europe | 1992 | 71.38000 | 5302888 | 9498.4677  |
| 1378 | Slovak Republic | Europe | 1997 | 72.71000 | 5383010 | 12126.2306 |
| 1379 | Slovak Republic | Europe | 2002 | 73.80000 | 5410052 | 13638.7784 |
| 1380 | Slovak Republic | Europe | 2007 | 74.66300 | 5447502 | 18678.3144 |
| 1381 | Slovenia        | Europe | 1952 | 65.57000 | 1489518 | 4215.0417  |
| 1382 | Slovenia        | Europe | 1957 | 67.85000 | 1533070 | 5862.2766  |
| 1383 | Slovenia        | Europe | 1962 | 69.15000 | 1582962 | 7402.3034  |
| 1384 | Slovenia        | Europe | 1967 | 69.18000 | 1646912 | 9405.4894  |
| 1385 | Slovenia        | Europe | 1972 | 69.82000 | 1694510 | 12383.4862 |
| 1386 | Slovenia        | Europe | 1977 | 70.97000 | 1746919 | 15277.0302 |
| 1387 | Slovenia        | Europe | 1982 | 71.06300 | 1861252 | 17866.7218 |
| 1388 | Slovenia        | Europe | 1987 | 72.25000 | 1945870 | 18678.5349 |
| 1389 | Slovenia        | Europe | 1992 | 73.64000 | 1999210 | 14214.7168 |
| 1390 | Slovenia        | Europe | 1997 | 75.13000 | 2011612 | 17161.1073 |

|      |              |        |      |          |          |            |
|------|--------------|--------|------|----------|----------|------------|
| 1391 | Slovenia     | Europe | 2002 | 76.66000 | 2011497  | 20660.0194 |
| 1392 | Slovenia     | Europe | 2007 | 77.92600 | 2009245  | 25768.2576 |
| 1393 | Somalia      | Africa | 1952 | 32.97800 | 2526994  | 1135.7498  |
| 1394 | Somalia      | Africa | 1957 | 34.97700 | 2780415  | 1258.1474  |
| 1395 | Somalia      | Africa | 1962 | 36.98100 | 3080153  | 1369.4883  |
| 1396 | Somalia      | Africa | 1967 | 38.97700 | 3428839  | 1284.7332  |
| 1397 | Somalia      | Africa | 1972 | 40.97300 | 3840161  | 1254.5761  |
| 1398 | Somalia      | Africa | 1977 | 41.97400 | 4353666  | 1450.9925  |
| 1399 | Somalia      | Africa | 1982 | 42.95500 | 5828892  | 1176.8070  |
| 1400 | Somalia      | Africa | 1987 | 44.50100 | 6921858  | 1093.2450  |
| 1401 | Somalia      | Africa | 1992 | 39.65800 | 6099799  | 926.9603   |
| 1402 | Somalia      | Africa | 1997 | 43.79500 | 6633514  | 930.5964   |
| 1403 | Somalia      | Africa | 2002 | 45.93600 | 7753310  | 882.0818   |
| 1404 | Somalia      | Africa | 2007 | 48.15900 | 9118773  | 926.1411   |
| 1405 | South Africa | Africa | 1952 | 45.00900 | 14264935 | 4725.2955  |
| 1406 | South Africa | Africa | 1957 | 47.98500 | 16151549 | 5487.1042  |
| 1407 | South Africa | Africa | 1962 | 49.95100 | 18356657 | 5768.7297  |
| 1408 | South Africa | Africa | 1967 | 51.92700 | 20997321 | 7114.4780  |
| 1409 | South Africa | Africa | 1972 | 53.69600 | 23935810 | 7765.9626  |
| 1410 | South Africa | Africa | 1977 | 55.52700 | 27129932 | 8028.6514  |
| 1411 | South Africa | Africa | 1982 | 58.16100 | 31140029 | 8568.2662  |
| 1412 | South Africa | Africa | 1987 | 60.83400 | 35933379 | 7825.8234  |
| 1413 | South Africa | Africa | 1992 | 61.88800 | 39964159 | 7225.0693  |
| 1414 | South Africa | Africa | 1997 | 60.23600 | 42835005 | 7479.1882  |
| 1415 | South Africa | Africa | 2002 | 53.36500 | 44433622 | 7710.9464  |
| 1416 | South Africa | Africa | 2007 | 49.33900 | 43997828 | 9269.6578  |
| 1417 | Spain        | Europe | 1952 | 64.94000 | 28549870 | 3834.0347  |
| 1418 | Spain        | Europe | 1957 | 66.66000 | 29841614 | 4564.8024  |
| 1419 | Spain        | Europe | 1962 | 69.69000 | 31158061 | 5693.8439  |
| 1420 | Spain        | Europe | 1967 | 71.44000 | 32850275 | 7993.5123  |
| 1421 | Spain        | Europe | 1972 | 73.06000 | 34513161 | 10638.7513 |
| 1422 | Spain        | Europe | 1977 | 74.39000 | 36439000 | 13236.9212 |
| 1423 | Spain        | Europe | 1982 | 76.30000 | 37983310 | 13926.1700 |
| 1424 | Spain        | Europe | 1987 | 76.90000 | 38880702 | 15764.9831 |
| 1425 | Spain        | Europe | 1992 | 77.57000 | 39549438 | 18603.0645 |
| 1426 | Spain        | Europe | 1997 | 78.77000 | 39855442 | 20445.2990 |
| 1427 | Spain        | Europe | 2002 | 79.78000 | 40152517 | 24835.4717 |
| 1428 | Spain        | Europe | 2007 | 80.94100 | 40448191 | 28821.0637 |
| 1429 | Sri Lanka    | Asia   | 1952 | 57.59300 | 7982342  | 1083.5320  |
| 1430 | Sri Lanka    | Asia   | 1957 | 61.45600 | 9128546  | 1072.5466  |
| 1431 | Sri Lanka    | Asia   | 1962 | 62.19200 | 10421936 | 1074.4720  |
| 1432 | Sri Lanka    | Asia   | 1967 | 64.26600 | 11737396 | 1135.5143  |
| 1433 | Sri Lanka    | Asia   | 1972 | 65.04200 | 13016733 | 1213.3955  |

|      |           |        |      |          |          |            |
|------|-----------|--------|------|----------|----------|------------|
| 1434 | Sri Lanka | Asia   | 1977 | 65.94900 | 14116836 | 1348.7757  |
| 1435 | Sri Lanka | Asia   | 1982 | 68.75700 | 15410151 | 1648.0798  |
| 1436 | Sri Lanka | Asia   | 1987 | 69.01100 | 16495304 | 1876.7668  |
| 1437 | Sri Lanka | Asia   | 1992 | 70.37900 | 17587060 | 2153.7392  |
| 1438 | Sri Lanka | Asia   | 1997 | 70.45700 | 18698655 | 2664.4773  |
| 1439 | Sri Lanka | Asia   | 2002 | 70.81500 | 19576783 | 3015.3788  |
| 1440 | Sri Lanka | Asia   | 2007 | 72.39600 | 20378239 | 3970.0954  |
| 1441 | Sudan     | Africa | 1952 | 38.63500 | 8504667  | 1615.9911  |
| 1442 | Sudan     | Africa | 1957 | 39.62400 | 9753392  | 1770.3371  |
| 1443 | Sudan     | Africa | 1962 | 40.87000 | 11183227 | 1959.5938  |
| 1444 | Sudan     | Africa | 1967 | 42.85800 | 12716129 | 1687.9976  |
| 1445 | Sudan     | Africa | 1972 | 45.08300 | 14597019 | 1659.6528  |
| 1446 | Sudan     | Africa | 1977 | 47.80000 | 17104986 | 2202.9884  |
| 1447 | Sudan     | Africa | 1982 | 50.33800 | 20367053 | 1895.5441  |
| 1448 | Sudan     | Africa | 1987 | 51.74400 | 24725960 | 1507.8192  |
| 1449 | Sudan     | Africa | 1992 | 53.55600 | 28227588 | 1492.1970  |
| 1450 | Sudan     | Africa | 1997 | 55.37300 | 32160729 | 1632.2108  |
| 1451 | Sudan     | Africa | 2002 | 56.36900 | 37090298 | 1993.3983  |
| 1452 | Sudan     | Africa | 2007 | 58.55600 | 42292929 | 2602.3950  |
| 1453 | Swaziland | Africa | 1952 | 41.40700 | 290243   | 1148.3766  |
| 1454 | Swaziland | Africa | 1957 | 43.42400 | 326741   | 1244.7084  |
| 1455 | Swaziland | Africa | 1962 | 44.99200 | 370006   | 1856.1821  |
| 1456 | Swaziland | Africa | 1967 | 46.63300 | 420690   | 2613.1017  |
| 1457 | Swaziland | Africa | 1972 | 49.55200 | 480105   | 3364.8366  |
| 1458 | Swaziland | Africa | 1977 | 52.53700 | 551425   | 3781.4106  |
| 1459 | Swaziland | Africa | 1982 | 55.56100 | 649901   | 3895.3840  |
| 1460 | Swaziland | Africa | 1987 | 57.67800 | 779348   | 3984.8398  |
| 1461 | Swaziland | Africa | 1992 | 58.47400 | 962344   | 3553.0224  |
| 1462 | Swaziland | Africa | 1997 | 54.28900 | 1054486  | 3876.7685  |
| 1463 | Swaziland | Africa | 2002 | 43.86900 | 1130269  | 4128.1169  |
| 1464 | Swaziland | Africa | 2007 | 39.61300 | 1133066  | 4513.4806  |
| 1465 | Sweden    | Europe | 1952 | 71.86000 | 7124673  | 8527.8447  |
| 1466 | Sweden    | Europe | 1957 | 72.49000 | 7363802  | 9911.8782  |
| 1467 | Sweden    | Europe | 1962 | 73.37000 | 7561588  | 12329.4419 |
| 1468 | Sweden    | Europe | 1967 | 74.16000 | 7867931  | 15258.2970 |
| 1469 | Sweden    | Europe | 1972 | 74.72000 | 8122293  | 17832.0246 |
| 1470 | Sweden    | Europe | 1977 | 75.44000 | 8251648  | 18855.7252 |
| 1471 | Sweden    | Europe | 1982 | 76.42000 | 8325260  | 20667.3812 |
| 1472 | Sweden    | Europe | 1987 | 77.19000 | 8421403  | 23586.9293 |
| 1473 | Sweden    | Europe | 1992 | 78.16000 | 8718867  | 23880.0168 |
| 1474 | Sweden    | Europe | 1997 | 79.39000 | 8897619  | 25266.5950 |
| 1475 | Sweden    | Europe | 2002 | 80.04000 | 8954175  | 29341.6309 |
| 1476 | Sweden    | Europe | 2007 | 80.88400 | 9031088  | 33859.7484 |

|      |             |        |      |          |          |            |
|------|-------------|--------|------|----------|----------|------------|
| 1477 | Switzerland | Europe | 1952 | 69.62000 | 4815000  | 14734.2327 |
| 1478 | Switzerland | Europe | 1957 | 70.56000 | 5126000  | 17909.4897 |
| 1479 | Switzerland | Europe | 1962 | 71.32000 | 5666000  | 20431.0927 |
| 1480 | Switzerland | Europe | 1967 | 72.77000 | 6063000  | 22966.1443 |
| 1481 | Switzerland | Europe | 1972 | 73.78000 | 6401400  | 27195.1130 |
| 1482 | Switzerland | Europe | 1977 | 75.39000 | 6316424  | 26982.2905 |
| 1483 | Switzerland | Europe | 1982 | 76.21000 | 6468126  | 28397.7151 |
| 1484 | Switzerland | Europe | 1987 | 77.41000 | 6649942  | 30281.7046 |
| 1485 | Switzerland | Europe | 1992 | 78.03000 | 6995447  | 31871.5303 |
| 1486 | Switzerland | Europe | 1997 | 79.37000 | 7193761  | 32135.3230 |
| 1487 | Switzerland | Europe | 2002 | 80.62000 | 7361757  | 34480.9577 |
| 1488 | Switzerland | Europe | 2007 | 81.70100 | 7554661  | 37506.4191 |
| 1489 | Syria       | Asia   | 1952 | 45.88300 | 3661549  | 1643.4854  |
| 1490 | Syria       | Asia   | 1957 | 48.28400 | 4149908  | 2117.2349  |
| 1491 | Syria       | Asia   | 1962 | 50.30500 | 4834621  | 2193.0371  |
| 1492 | Syria       | Asia   | 1967 | 53.65500 | 5680812  | 1881.9236  |
| 1493 | Syria       | Asia   | 1972 | 57.29600 | 6701172  | 2571.4230  |
| 1494 | Syria       | Asia   | 1977 | 61.19500 | 7932503  | 3195.4846  |
| 1495 | Syria       | Asia   | 1982 | 64.59000 | 9410494  | 3761.8377  |
| 1496 | Syria       | Asia   | 1987 | 66.97400 | 11242847 | 3116.7743  |
| 1497 | Syria       | Asia   | 1992 | 69.24900 | 13219062 | 3340.5428  |
| 1498 | Syria       | Asia   | 1997 | 71.52700 | 15081016 | 4014.2390  |
| 1499 | Syria       | Asia   | 2002 | 73.05300 | 17155814 | 4090.9253  |
| 1500 | Syria       | Asia   | 2007 | 74.14300 | 19314747 | 4184.5481  |
| 1501 | Taiwan      | Asia   | 1952 | 58.50000 | 8550362  | 1206.9479  |
| 1502 | Taiwan      | Asia   | 1957 | 62.40000 | 10164215 | 1507.8613  |
| 1503 | Taiwan      | Asia   | 1962 | 65.20000 | 11918938 | 1822.8790  |
| 1504 | Taiwan      | Asia   | 1967 | 67.50000 | 13648692 | 2643.8587  |
| 1505 | Taiwan      | Asia   | 1972 | 69.39000 | 15226039 | 4062.5239  |
| 1506 | Taiwan      | Asia   | 1977 | 70.59000 | 16785196 | 5596.5198  |
| 1507 | Taiwan      | Asia   | 1982 | 72.16000 | 18501390 | 7426.3548  |
| 1508 | Taiwan      | Asia   | 1987 | 73.40000 | 19757799 | 11054.5618 |
| 1509 | Taiwan      | Asia   | 1992 | 74.26000 | 20686918 | 15215.6579 |
| 1510 | Taiwan      | Asia   | 1997 | 75.25000 | 21628605 | 20206.8210 |
| 1511 | Taiwan      | Asia   | 2002 | 76.99000 | 22454239 | 23235.4233 |
| 1512 | Taiwan      | Asia   | 2007 | 78.40000 | 23174294 | 28718.2768 |
| 1513 | Tanzania    | Africa | 1952 | 41.21500 | 8322925  | 716.6501   |
| 1514 | Tanzania    | Africa | 1957 | 42.97400 | 9452826  | 698.5356   |
| 1515 | Tanzania    | Africa | 1962 | 44.24600 | 10863958 | 722.0038   |
| 1516 | Tanzania    | Africa | 1967 | 45.75700 | 12607312 | 848.2187   |
| 1517 | Tanzania    | Africa | 1972 | 47.62000 | 14706593 | 915.9851   |
| 1518 | Tanzania    | Africa | 1977 | 49.91900 | 17129565 | 962.4923   |
| 1519 | Tanzania    | Africa | 1982 | 50.60800 | 19844382 | 874.2426   |

|      |                     |          |      |          |          |            |
|------|---------------------|----------|------|----------|----------|------------|
| 1520 | Tanzania            | Africa   | 1987 | 51.53500 | 23040630 | 831.8221   |
| 1521 | Tanzania            | Africa   | 1992 | 50.44000 | 26605473 | 825.6825   |
| 1522 | Tanzania            | Africa   | 1997 | 48.46600 | 30686889 | 789.1862   |
| 1523 | Tanzania            | Africa   | 2002 | 49.65100 | 34593779 | 899.0742   |
| 1524 | Tanzania            | Africa   | 2007 | 52.51700 | 38139640 | 1107.4822  |
| 1525 | Thailand            | Asia     | 1952 | 50.84800 | 21289402 | 757.7974   |
| 1526 | Thailand            | Asia     | 1957 | 53.63000 | 25041917 | 793.5774   |
| 1527 | Thailand            | Asia     | 1962 | 56.06100 | 29263397 | 1002.1992  |
| 1528 | Thailand            | Asia     | 1967 | 58.28500 | 34024249 | 1295.4607  |
| 1529 | Thailand            | Asia     | 1972 | 60.40500 | 39276153 | 1524.3589  |
| 1530 | Thailand            | Asia     | 1977 | 62.49400 | 44148285 | 1961.2246  |
| 1531 | Thailand            | Asia     | 1982 | 64.59700 | 48827160 | 2393.2198  |
| 1532 | Thailand            | Asia     | 1987 | 66.08400 | 52910342 | 2982.6538  |
| 1533 | Thailand            | Asia     | 1992 | 67.29800 | 56667095 | 4616.8965  |
| 1534 | Thailand            | Asia     | 1997 | 67.52100 | 60216677 | 5852.6255  |
| 1535 | Thailand            | Asia     | 2002 | 68.56400 | 62806748 | 5913.1875  |
| 1536 | Thailand            | Asia     | 2007 | 70.61600 | 65068149 | 7458.3963  |
| 1537 | Togo                | Africa   | 1952 | 38.59600 | 1219113  | 859.8087   |
| 1538 | Togo                | Africa   | 1957 | 41.20800 | 1357445  | 925.9083   |
| 1539 | Togo                | Africa   | 1962 | 43.92200 | 1528098  | 1067.5348  |
| 1540 | Togo                | Africa   | 1967 | 46.76900 | 1735550  | 1477.5968  |
| 1541 | Togo                | Africa   | 1972 | 49.75900 | 2056351  | 1649.6602  |
| 1542 | Togo                | Africa   | 1977 | 52.88700 | 2308582  | 1532.7770  |
| 1543 | Togo                | Africa   | 1982 | 55.47100 | 2644765  | 1344.5780  |
| 1544 | Togo                | Africa   | 1987 | 56.94100 | 3154264  | 1202.2014  |
| 1545 | Togo                | Africa   | 1992 | 58.06100 | 3747553  | 1034.2989  |
| 1546 | Togo                | Africa   | 1997 | 58.39000 | 4320890  | 982.2869   |
| 1547 | Togo                | Africa   | 2002 | 57.56100 | 4977378  | 886.2206   |
| 1548 | Togo                | Africa   | 2007 | 58.42000 | 5701579  | 882.9699   |
| 1549 | Trinidad and Tobago | Americas | 1952 | 59.10000 | 662850   | 3023.2719  |
| 1550 | Trinidad and Tobago | Americas | 1957 | 61.80000 | 764900   | 4100.3934  |
| 1551 | Trinidad and Tobago | Americas | 1962 | 64.90000 | 887498   | 4997.5240  |
| 1552 | Trinidad and Tobago | Americas | 1967 | 65.40000 | 960155   | 5621.3685  |
| 1553 | Trinidad and Tobago | Americas | 1972 | 65.90000 | 975199   | 6619.5514  |
| 1554 | Trinidad and Tobago | Americas | 1977 | 68.30000 | 1039009  | 7899.5542  |
| 1555 | Trinidad and Tobago | Americas | 1982 | 68.83200 | 1116479  | 9119.5286  |
| 1556 | Trinidad and Tobago | Americas | 1987 | 69.58200 | 1191336  | 7388.5978  |
| 1557 | Trinidad and Tobago | Americas | 1992 | 69.86200 | 1183669  | 7370.9909  |
| 1558 | Trinidad and Tobago | Americas | 1997 | 69.46500 | 1138101  | 8792.5731  |
| 1559 | Trinidad and Tobago | Americas | 2002 | 68.97600 | 1101832  | 11460.6002 |
| 1560 | Trinidad and Tobago | Americas | 2007 | 69.81900 | 1056608  | 18008.5092 |
| 1561 | Tunisia             | Africa   | 1952 | 44.60000 | 3647735  | 1468.4756  |
| 1562 | Tunisia             | Africa   | 1957 | 47.10000 | 3950849  | 1395.2325  |

|      |                |        |      |          |          |            |
|------|----------------|--------|------|----------|----------|------------|
| 1563 | Tunisia        | Africa | 1962 | 49.57900 | 4286552  | 1660.3032  |
| 1564 | Tunisia        | Africa | 1967 | 52.05300 | 4786986  | 1932.3602  |
| 1565 | Tunisia        | Africa | 1972 | 55.60200 | 5303507  | 2753.2860  |
| 1566 | Tunisia        | Africa | 1977 | 59.83700 | 6005061  | 3120.8768  |
| 1567 | Tunisia        | Africa | 1982 | 64.04800 | 6734098  | 3560.2332  |
| 1568 | Tunisia        | Africa | 1987 | 66.89400 | 7724976  | 3810.4193  |
| 1569 | Tunisia        | Africa | 1992 | 70.00100 | 8523077  | 4332.7202  |
| 1570 | Tunisia        | Africa | 1997 | 71.97300 | 9231669  | 4876.7986  |
| 1571 | Tunisia        | Africa | 2002 | 73.04200 | 9770575  | 5722.8957  |
| 1572 | Tunisia        | Africa | 2007 | 73.92300 | 10276158 | 7092.9230  |
| 1573 | Turkey         | Europe | 1952 | 43.58500 | 22235677 | 1969.1010  |
| 1574 | Turkey         | Europe | 1957 | 48.07900 | 25670939 | 2218.7543  |
| 1575 | Turkey         | Europe | 1962 | 52.09800 | 29788695 | 2322.8699  |
| 1576 | Turkey         | Europe | 1967 | 54.33600 | 33411317 | 2826.3564  |
| 1577 | Turkey         | Europe | 1972 | 57.00500 | 37492953 | 3450.6964  |
| 1578 | Turkey         | Europe | 1977 | 59.50700 | 42404033 | 4269.1223  |
| 1579 | Turkey         | Europe | 1982 | 61.03600 | 47328791 | 4241.3563  |
| 1580 | Turkey         | Europe | 1987 | 63.10800 | 52881328 | 5089.0437  |
| 1581 | Turkey         | Europe | 1992 | 66.14600 | 58179144 | 5678.3483  |
| 1582 | Turkey         | Europe | 1997 | 68.83500 | 63047647 | 6601.4299  |
| 1583 | Turkey         | Europe | 2002 | 70.84500 | 67308928 | 6508.0857  |
| 1584 | Turkey         | Europe | 2007 | 71.77700 | 71158647 | 8458.2764  |
| 1585 | Uganda         | Africa | 1952 | 39.97800 | 5824797  | 734.7535   |
| 1586 | Uganda         | Africa | 1957 | 42.57100 | 6675501  | 774.3711   |
| 1587 | Uganda         | Africa | 1962 | 45.34400 | 7688797  | 767.2717   |
| 1588 | Uganda         | Africa | 1967 | 48.05100 | 8900294  | 908.9185   |
| 1589 | Uganda         | Africa | 1972 | 51.01600 | 10190285 | 950.7359   |
| 1590 | Uganda         | Africa | 1977 | 50.35000 | 11457758 | 843.7331   |
| 1591 | Uganda         | Africa | 1982 | 49.84900 | 12939400 | 682.2662   |
| 1592 | Uganda         | Africa | 1987 | 51.50900 | 15283050 | 617.7244   |
| 1593 | Uganda         | Africa | 1992 | 48.82500 | 18252190 | 644.1708   |
| 1594 | Uganda         | Africa | 1997 | 44.57800 | 21210254 | 816.5591   |
| 1595 | Uganda         | Africa | 2002 | 47.81300 | 24739869 | 927.7210   |
| 1596 | Uganda         | Africa | 2007 | 51.54200 | 29170398 | 1056.3801  |
| 1597 | United Kingdom | Europe | 1952 | 69.18000 | 50430000 | 9979.5085  |
| 1598 | United Kingdom | Europe | 1957 | 70.42000 | 51430000 | 11283.1779 |
| 1599 | United Kingdom | Europe | 1962 | 70.76000 | 53292000 | 12477.1771 |
| 1600 | United Kingdom | Europe | 1967 | 71.36000 | 54959000 | 14142.8509 |
| 1601 | United Kingdom | Europe | 1972 | 72.01000 | 56079000 | 15895.1164 |
| 1602 | United Kingdom | Europe | 1977 | 72.76000 | 56179000 | 17428.7485 |
| 1603 | United Kingdom | Europe | 1982 | 74.04000 | 56339704 | 18232.4245 |
| 1604 | United Kingdom | Europe | 1987 | 75.00700 | 56981620 | 21664.7877 |
| 1605 | United Kingdom | Europe | 1992 | 76.42000 | 57866349 | 22705.0925 |

|      |                |          |      |          |           |            |
|------|----------------|----------|------|----------|-----------|------------|
| 1606 | United Kingdom | Europe   | 1997 | 77.21800 | 58808266  | 26074.5314 |
| 1607 | United Kingdom | Europe   | 2002 | 78.47100 | 59912431  | 29478.9992 |
| 1608 | United Kingdom | Europe   | 2007 | 79.42500 | 60776238  | 33203.2613 |
| 1609 | United States  | Americas | 1952 | 68.44000 | 157553000 | 13990.4821 |
| 1610 | United States  | Americas | 1957 | 69.49000 | 171984000 | 14847.1271 |
| 1611 | United States  | Americas | 1962 | 70.21000 | 186538000 | 16173.1459 |
| 1612 | United States  | Americas | 1967 | 70.76000 | 198712000 | 19530.3656 |
| 1613 | United States  | Americas | 1972 | 71.34000 | 209896000 | 21806.0359 |
| 1614 | United States  | Americas | 1977 | 73.38000 | 220239000 | 24072.6321 |
| 1615 | United States  | Americas | 1982 | 74.65000 | 232187835 | 25009.5591 |
| 1616 | United States  | Americas | 1987 | 75.02000 | 242803533 | 29884.3504 |
| 1617 | United States  | Americas | 1992 | 76.09000 | 256894189 | 32003.9322 |
| 1618 | United States  | Americas | 1997 | 76.81000 | 272911760 | 35767.4330 |
| 1619 | United States  | Americas | 2002 | 77.31000 | 287675526 | 39097.0995 |
| 1620 | United States  | Americas | 2007 | 78.24200 | 301139947 | 42951.6531 |
| 1621 | Uruguay        | Americas | 1952 | 66.07100 | 2252965   | 5716.7667  |
| 1622 | Uruguay        | Americas | 1957 | 67.04400 | 2424959   | 6150.7730  |
| 1623 | Uruguay        | Americas | 1962 | 68.25300 | 2598466   | 5603.3577  |
| 1624 | Uruguay        | Americas | 1967 | 68.46800 | 2748579   | 5444.6196  |
| 1625 | Uruguay        | Americas | 1972 | 68.67300 | 2829526   | 5703.4089  |
| 1626 | Uruguay        | Americas | 1977 | 69.48100 | 2873520   | 6504.3397  |
| 1627 | Uruguay        | Americas | 1982 | 70.80500 | 2953997   | 6920.2231  |
| 1628 | Uruguay        | Americas | 1987 | 71.91800 | 3045153   | 7452.3990  |
| 1629 | Uruguay        | Americas | 1992 | 72.75200 | 3149262   | 8137.0048  |
| 1630 | Uruguay        | Americas | 1997 | 74.22300 | 3262838   | 9230.2407  |
| 1631 | Uruguay        | Americas | 2002 | 75.30700 | 3363085   | 7727.0020  |
| 1632 | Uruguay        | Americas | 2007 | 76.38400 | 3447496   | 10611.4630 |
| 1633 | Venezuela      | Americas | 1952 | 55.08800 | 5439568   | 7689.7998  |
| 1634 | Venezuela      | Americas | 1957 | 57.90700 | 6702668   | 9802.4665  |
| 1635 | Venezuela      | Americas | 1962 | 60.77000 | 8143375   | 8422.9742  |
| 1636 | Venezuela      | Americas | 1967 | 63.47900 | 9709552   | 9541.4742  |
| 1637 | Venezuela      | Americas | 1972 | 65.71200 | 11515649  | 10505.2597 |
| 1638 | Venezuela      | Americas | 1977 | 67.45600 | 13503563  | 13143.9510 |
| 1639 | Venezuela      | Americas | 1982 | 68.55700 | 15620766  | 11152.4101 |
| 1640 | Venezuela      | Americas | 1987 | 70.19000 | 17910182  | 9883.5846  |
| 1641 | Venezuela      | Americas | 1992 | 71.15000 | 20265563  | 10733.9263 |
| 1642 | Venezuela      | Americas | 1997 | 72.14600 | 22374398  | 10165.4952 |
| 1643 | Venezuela      | Americas | 2002 | 72.76600 | 24287670  | 8605.0478  |
| 1644 | Venezuela      | Americas | 2007 | 73.74700 | 26084662  | 11415.8057 |
| 1645 | Vietnam        | Asia     | 1952 | 40.41200 | 26246839  | 605.0665   |
| 1646 | Vietnam        | Asia     | 1957 | 42.88700 | 28998543  | 676.2854   |
| 1647 | Vietnam        | Asia     | 1962 | 45.36300 | 33796140  | 772.0492   |
| 1648 | Vietnam        | Asia     | 1967 | 47.83800 | 39463910  | 637.1233   |

|      |                    |        |      |          |          |           |
|------|--------------------|--------|------|----------|----------|-----------|
| 1649 | Vietnam            | Asia   | 1972 | 50.25400 | 44655014 | 699.5016  |
| 1650 | Vietnam            | Asia   | 1977 | 55.76400 | 50533506 | 713.5371  |
| 1651 | Vietnam            | Asia   | 1982 | 58.81600 | 56142181 | 707.2358  |
| 1652 | Vietnam            | Asia   | 1987 | 62.82000 | 62826491 | 820.7994  |
| 1653 | Vietnam            | Asia   | 1992 | 67.66200 | 69940728 | 989.0231  |
| 1654 | Vietnam            | Asia   | 1997 | 70.67200 | 76048996 | 1385.8968 |
| 1655 | Vietnam            | Asia   | 2002 | 73.01700 | 80908147 | 1764.4567 |
| 1656 | Vietnam            | Asia   | 2007 | 74.24900 | 85262356 | 2441.5764 |
| 1657 | West Bank and Gaza | Asia   | 1952 | 43.16000 | 1030585  | 1515.5923 |
| 1658 | West Bank and Gaza | Asia   | 1957 | 45.67100 | 1070439  | 1827.0677 |
| 1659 | West Bank and Gaza | Asia   | 1962 | 48.12700 | 1133134  | 2198.9563 |
| 1660 | West Bank and Gaza | Asia   | 1967 | 51.63100 | 1142636  | 2649.7150 |
| 1661 | West Bank and Gaza | Asia   | 1972 | 56.53200 | 1089572  | 3133.4093 |
| 1662 | West Bank and Gaza | Asia   | 1977 | 60.76500 | 1261091  | 3682.8315 |
| 1663 | West Bank and Gaza | Asia   | 1982 | 64.40600 | 1425876  | 4336.0321 |
| 1664 | West Bank and Gaza | Asia   | 1987 | 67.04600 | 1691210  | 5107.1974 |
| 1665 | West Bank and Gaza | Asia   | 1992 | 69.71800 | 2104779  | 6017.6548 |
| 1666 | West Bank and Gaza | Asia   | 1997 | 71.09600 | 2826046  | 7110.6676 |
| 1667 | West Bank and Gaza | Asia   | 2002 | 72.37000 | 3389578  | 4515.4876 |
| 1668 | West Bank and Gaza | Asia   | 2007 | 73.42200 | 4018332  | 3025.3498 |
| 1669 | Yemen, Rep.        | Asia   | 1952 | 32.54800 | 4963829  | 781.7176  |
| 1670 | Yemen, Rep.        | Asia   | 1957 | 33.97000 | 5498090  | 804.8305  |
| 1671 | Yemen, Rep.        | Asia   | 1962 | 35.18000 | 6120081  | 825.6232  |
| 1672 | Yemen, Rep.        | Asia   | 1967 | 36.98400 | 6740785  | 862.4421  |
| 1673 | Yemen, Rep.        | Asia   | 1972 | 39.84800 | 7407075  | 1265.0470 |
| 1674 | Yemen, Rep.        | Asia   | 1977 | 44.17500 | 8403990  | 1829.7652 |
| 1675 | Yemen, Rep.        | Asia   | 1982 | 49.11300 | 9657618  | 1977.5570 |
| 1676 | Yemen, Rep.        | Asia   | 1987 | 52.92200 | 11219340 | 1971.7415 |
| 1677 | Yemen, Rep.        | Asia   | 1992 | 55.59900 | 13367997 | 1879.4967 |
| 1678 | Yemen, Rep.        | Asia   | 1997 | 58.02000 | 15826497 | 2117.4845 |
| 1679 | Yemen, Rep.        | Asia   | 2002 | 60.30800 | 18701257 | 2234.8208 |
| 1680 | Yemen, Rep.        | Asia   | 2007 | 62.69800 | 22211743 | 2280.7699 |
| 1681 | Zambia             | Africa | 1952 | 42.03800 | 2672000  | 1147.3888 |
| 1682 | Zambia             | Africa | 1957 | 44.07700 | 3016000  | 1311.9568 |
| 1683 | Zambia             | Africa | 1962 | 46.02300 | 3421000  | 1452.7258 |
| 1684 | Zambia             | Africa | 1967 | 47.76800 | 3900000  | 1777.0773 |
| 1685 | Zambia             | Africa | 1972 | 50.10700 | 4506497  | 1773.4983 |
| 1686 | Zambia             | Africa | 1977 | 51.38600 | 5216550  | 1588.6883 |
| 1687 | Zambia             | Africa | 1982 | 51.82100 | 6100407  | 1408.6786 |
| 1688 | Zambia             | Africa | 1987 | 50.82100 | 7272406  | 1213.3151 |
| 1689 | Zambia             | Africa | 1992 | 46.10000 | 8381163  | 1210.8846 |
| 1690 | Zambia             | Africa | 1997 | 40.23800 | 9417789  | 1071.3538 |
| 1691 | Zambia             | Africa | 2002 | 39.19300 | 10595811 | 1071.6139 |

|      |          |        |      |          |          |           |
|------|----------|--------|------|----------|----------|-----------|
| 1692 | Zambia   | Africa | 2007 | 42.38400 | 11746035 | 1271.2116 |
| 1693 | Zimbabwe | Africa | 1952 | 48.45100 | 3080907  | 406.8841  |
| 1694 | Zimbabwe | Africa | 1957 | 50.46900 | 3646340  | 518.7643  |
| 1695 | Zimbabwe | Africa | 1962 | 52.35800 | 4277736  | 527.2722  |
| 1696 | Zimbabwe | Africa | 1967 | 53.99500 | 4995432  | 569.7951  |
| 1697 | Zimbabwe | Africa | 1972 | 55.63500 | 5861135  | 799.3622  |
| 1698 | Zimbabwe | Africa | 1977 | 57.67400 | 6642107  | 685.5877  |
| 1699 | Zimbabwe | Africa | 1982 | 60.36300 | 7636524  | 788.8550  |
| 1700 | Zimbabwe | Africa | 1987 | 62.35100 | 9216418  | 706.1573  |
| 1701 | Zimbabwe | Africa | 1992 | 60.37700 | 10704340 | 693.4208  |
| 1702 | Zimbabwe | Africa | 1997 | 46.80900 | 11404948 | 792.4500  |
| 1703 | Zimbabwe | Africa | 2002 | 39.98900 | 11926563 | 672.0386  |
| 1704 | Zimbabwe | Africa | 2007 | 43.48700 | 12311143 | 469.7093  |

This prints out A LOT of data (I've contained the output in a nice scrollly box, but if you did this in a standard quarto document or in your console, the entire thing will be printed out, sans scrollly box). In general, you want to avoid printing your entire dataset in your R console or rendered quarto document.

Instead, try printing just the first few (6, to be exact) rows using the `head()` function:

```
head(gapminder)
```

|   | country     | continent | year | lifeExp | pop      | gdpPerCap |
|---|-------------|-----------|------|---------|----------|-----------|
| 1 | Afghanistan | Asia      | 1952 | 28.801  | 8425333  | 779.4453  |
| 2 | Afghanistan | Asia      | 1957 | 30.332  | 9240934  | 820.8530  |
| 3 | Afghanistan | Asia      | 1962 | 31.997  | 10267083 | 853.1007  |
| 4 | Afghanistan | Asia      | 1967 | 34.020  | 11537966 | 836.1971  |
| 5 | Afghanistan | Asia      | 1972 | 36.088  | 13079460 | 739.9811  |
| 6 | Afghanistan | Asia      | 1977 | 38.438  | 14880372 | 786.1134  |

Now that we are starting to get a handle on our gapminder data frame, let's talk about the information it contains. The gapminder dataset contains information on life expectancy, population, and GDP per capita for 142 countries every 5 years between 1952 to 2007. Each country has 12 rows in the data, one for each year.

If you want to learn more about the gapminder dataset, head on over to the [gapminder website](#).

## 5.2 Attributes of a data frame

Often I find it helpful to print out just the column names of a data frame using the `colnames()` function:

```
colnames(gapminder)
```

```
[1] "country"    "continent"   "year"        "lifeExp"     "pop"        "gdpPercap"
```

We can also ask things like how many rows our data frame has using the `nrow()` function:

```
nrow(gapminder)
```

```
[1] 1704
```

We can ask how many columns our data frame has using the `ncol()` function:

```
ncol(gapminder)
```

```
[1] 6
```

Or we can ask both how many rows and how many columns our data frame has at the same time using the `dim()` function:

```
dim(gapminder)
```

```
[1] 1704      6
```

We can use our trusty `str()` function from earlier to take a sneak peek at the “structure” of our data:

```
str(gapminder)
```

```
'data.frame': 1704 obs. of 6 variables:  
 $ country : chr  "Afghanistan" "Afghanistan" "Afghanistan" "Afghanistan" ...  
 $ continent: chr  "Asia" "Asia" "Asia" "Asia" ...  
 $ year     : int  1952 1957 1962 1967 1972 1977 1982 1987 1992 1997 ...  
 $ lifeExp  : num  28.8 30.3 32 34 36.1 ...  
 $ pop      : int  8425333 9240934 10267083 11537966 13079460 14880372 12881816 13867957 163... $ gdpPercap: num  779 821 853 836 740 ...
```

And we can use the `summary()` function to get some statistical summaries (like the minimum, median, mean, maximum, and the quartiles) of each of the numeric columns in our data frame (this summary is fairly useless for character/categorical columns though):

```
# use summary() to look at a summary of gapminder
summary(gapminder)
```

```
country           continent          year      lifeExp
Length:1704       Length:1704       Min.   :1952   Min.   :23.60
Class :character  Class  :character  1st Qu.:1966  1st Qu.:48.20
Mode  :character  Mode   :character  Median :1980  Median :60.71
                           Median   :1980  Mean    :59.47
                           3rd Qu.:1993  3rd Qu.:70.85
                           Max.    :2007  Max.    :82.60
pop                gdpPercap
Min.   :6.001e+04  Min.   : 241.2
1st Qu.:2.794e+06  1st Qu.: 1202.1
Median :7.024e+06  Median : 3531.8
Mean   :2.960e+07  Mean   : 7215.3
3rd Qu.:1.959e+07 3rd Qu.: 9325.5
Max.   :1.319e+09  Max.   :113523.1
```

## 5.3 Exercise

Your turn: [download the following world happiness dataset](#). Load the `whr_2023.csv` file into R, saving it as a variable called `world_happiness`.

Then print out the first 6 rows, the column names, create a summary of the data, and report its dimension.

## 5.4 Solution

Loading the data

```
world_happiness <- read.csv("data/whr_2023.csv")
```

Printing the first 6 rows:

```
head(world_happiness)
```

|   | country_name                     | year                         | life_ladder     | log_GDP_per_capita | social_support |    |
|---|----------------------------------|------------------------------|-----------------|--------------------|----------------|----|
| 1 | Afghanistan                      | 2005                         | NA              | NA                 | NA             | NA |
| 2 | Afghanistan                      | 2006                         | NA              | NA                 | NA             | NA |
| 3 | Afghanistan                      | 2007                         | NA              | NA                 | NA             | NA |
| 4 | Afghanistan                      | 2008                         | 3.724           | 7.350              | 0.451          |    |
| 5 | Afghanistan                      | 2009                         | 4.402           | 7.509              | 0.552          |    |
| 6 | Afghanistan                      | 2010                         | 4.758           | 7.614              | 0.539          |    |
|   | healthy_life_expectancy_at_birth | freedom_to_make_life_choices | generosity      |                    |                |    |
| 1 | NA                               | NA                           | NA              | NA                 | NA             | NA |
| 2 | NA                               | NA                           | NA              | NA                 | NA             | NA |
| 3 | NA                               | NA                           | NA              | NA                 | NA             | NA |
| 4 | 50.5                             | 0.718                        | 0.168           |                    |                |    |
| 5 | 50.8                             | 0.679                        | 0.191           |                    |                |    |
| 6 | 51.1                             | 0.600                        | 0.121           |                    |                |    |
|   | perceptions_of_corruption        | positive_affect              | negative_affect |                    |                |    |
| 1 | NA                               | NA                           | NA              | NA                 | NA             | NA |
| 2 | NA                               | NA                           | NA              | NA                 | NA             | NA |
| 3 | NA                               | NA                           | NA              | NA                 | NA             | NA |
| 4 | 0.882                            | 0.414                        | 0.258           |                    |                |    |
| 5 | 0.850                            | 0.481                        | 0.237           |                    |                |    |
| 6 | 0.707                            | 0.517                        | 0.275           |                    |                |    |

And looking at several features of the data:

```
str(world_happiness)
```

```
'data.frame': 2970 obs. of 11 variables:  
 $ country_name : chr "Afghanistan" "Afghanistan" "Afghanistan" "Afghanis...  
 $ year        : int 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 ...  
 $ life_ladder  : num NA NA NA 3.72 4.4 ...  
 $ log_GDP_per_capita : num NA NA NA 7.35 7.51 ...  
 $ social_support : num NA NA NA 0.451 0.552 0.539 0.521 0.521 0.484 0.526 ...  
 $ healthy_life_expectancy_at_birth: num NA NA NA 50.5 50.8 51.1 51.4 51.7 52 52.3 ...  
 $ freedom_to_make_life_choices : num NA NA NA 0.718 0.679 0.6 0.496 0.531 0.578 0.509 ...  
 $ generosity    : num NA NA NA 0.168 0.191 0.121 0.164 0.238 0.063 0.106 ...  
 $ perceptions_of_corruption : num NA NA NA 0.882 0.85 0.707 0.731 0.776 0.823 0.871 ...  
 $ positive_affect   : num NA NA NA 0.414 0.481 0.517 0.48 0.614 0.547 0.492 ...  
 $ negative_affect   : num NA NA NA 0.258 0.237 0.275 0.267 0.268 0.273 0.375 ...
```

```
summary(world_happiness)
```

|         | country_name    | year                             | life_ladder                  | log_GDP_per_capita |
|---------|-----------------|----------------------------------|------------------------------|--------------------|
| Length: | 2970            | Min. :2005                       | Min. :1.281                  | Min. : 5.527       |
| Class : | character       | 1st Qu.:2009                     | 1st Qu.:4.647                | 1st Qu.: 8.500     |
| Mode :  | character       | Median :2014                     | Median :5.432                | Median : 9.499     |
|         |                 | Mean :2014                       | Mean :5.479                  | Mean : 9.390       |
|         |                 | 3rd Qu.:2018                     | 3rd Qu.:6.309                | 3rd Qu.:10.373     |
|         |                 | Max. :2022                       | Max. :8.019                  | Max. :11.664       |
|         |                 | NA's :771                        | NA's :791                    | NA's :791          |
|         |                 |                                  |                              |                    |
|         | social_support  | healthy_life_expectancy_at_birth | freedom_to_make_life_choices |                    |
|         | Min. :0.2280    | Min. : 6.72                      | Min. :0.2580                 |                    |
|         | 1st Qu.:0.7470  | 1st Qu.:59.12                    | 1st Qu.:0.6562               |                    |
|         | Median :0.8360  | Median :65.05                    | Median :0.7700               |                    |
|         | Mean :0.8107    | Mean :63.29                      | Mean :0.7478                 |                    |
|         | 3rd Qu.:0.9050  | 3rd Qu.:68.50                    | 3rd Qu.:0.8590               |                    |
|         | Max. :0.9870    | Max. :74.47                      | Max. :0.9850                 |                    |
|         | NA's :784       | NA's :825                        | NA's :804                    |                    |
|         |                 |                                  |                              |                    |
|         | generosity      | perceptions_of_corruption        | positive_affect              | negative_affect    |
|         | Min. :-0.3380   | Min. :0.0350                     | Min. :0.1790                 | Min. :0.0830       |
|         | 1st Qu.:-0.1120 | 1st Qu.:0.6880                   | 1st Qu.:0.5720               | 1st Qu.:0.2080     |
|         | Median :-0.0230 | Median :0.8000                   | Median :0.6630               | Median :0.2610     |
|         | Mean : 0.0001   | Mean :0.7452                     | Mean :0.6521                 | Mean :0.2715       |
|         | 3rd Qu.: 0.0920 | 3rd Qu.:0.8690                   | 3rd Qu.:0.7380               | 3rd Qu.:0.3230     |
|         | Max. : 0.7030   | Max. :0.9830                     | Max. :0.8840                 | Max. :0.7050       |
|         | NA's :844       | NA's :887                        | NA's :795                    | NA's :787          |

```
dim(world_happiness)
```

```
[1] 2970   11
```

## 5.5 Loading data from Excel, SPSS, Stata, and SAS files

Loading data from Excel, SPSS, Stata, and files is almost as easy as loading data from .csv files, except that you will need to install some add-on packages to do so. Specifically, to load Excel files, you will need to install the “readxl” package, and to load SPSS, Stata, or SAS files, you’ll need to install the “haven” package.

You’ll learn about installing and loading packages in the next chapter. [Click here](#) to learn more about loading data from Excel files and [click here](#) to learn more about loading data from SPSS, Stata, and SAS files.

## **Part III**

# **The Tidyverse**

# 6 Data Frames in the Tidyverse

## 💡 Learn R live!

Prefer to learn via **live instruction**? Register for my [Introduction to R for Data Analysis](#) seminar via Instats on January 15-16 2025.

R is an open source programming language, which means that anyone can extend it by creating their own R functions. When someone creates a collection of related R functions, they typically bundle them into what is called a “package” or a “library” (I use these terms interchangeably), which can then be downloaded and used by other people.

I don’t think it’s an exaggeration to say that you probably wouldn’t be learning R today were it not for one particular package called the “tidyverse” (so named because it helps you create and work with “[tidy](#)” data). The tidyverse is actually a collection of several important R packages, including one called “dplyr” and another one called “ggplot2” (this chapter will introduce dplyr and you’ll get to know ggplot2 in the next chapter).

Although the tidyverse was originally created by Hadley Wickham, it has since grown to include contributions from hundreds of brilliant R developers. Together, they have revolutionized the way we use R for the better. The tidyverse and its impacts are a true testament to the power of the open source community.

## 6.1 Installing and Loading R packages

R packages are collections of “add-on” R functions that you can “load” into your R session to provide additional functionality.

To use functions from a package, you need to do two things:

1. Install the package on your computer. **You only need to do this once.**
2. Load your package into your current R session. **You need to do this every time you start a new R session (i.e., every time you open up RStudio).**

I like to think of *installing* an R package like installing a new application onto your computer. You only ever need to install the application once (unless you’re updating it), but you need to open it every time you want to use it (in this analogy, loading a library is like “opening” your application).

### 6.1.1 Installing an R package

So to get started with dplyr, ggplot2, and the other tidyverse packages, we need to *install* them. But to make our lives easier, we can simultaneously install all the tidyverse packages (ggplot2, dplyr, reshape, purrr, readr, and many others) by just installing the “tidyverse” package itself.

To install the “tidyverse” package (or any other package), write the following code *directly into your console* (I do *not* recommend saving this code in a quarto document or R script, because once you’ve run this code, you don’t need to run it again):

```
# write this code directly into the console:  
install.packages("tidyverse")
```

Note that you need to be connected to the internet to install a package (since it’s like downloading an application from the internet.)

### 6.1.2 Loading an R package

Once you’ve installed it, every time you want to *use* an installed R package in a new R session, you need to “*load*” it using the library() function.

```
library(tidyverse)
```

```
-- Attaching core tidyverse packages ----- tidyverse 2.0.0 --  
v dplyr     1.1.4      v readr     2.1.5  
v forcats   1.0.0      v stringr   1.5.1  
v ggplot2   3.5.1      v tibble    3.2.1  
v lubridate 1.9.3      v tidyr    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
```

Since you need to run this every time you open RStudio, you should include this code in the first chunk of your quarto document or R script.

When you load libraries into R, you'll often see a lot of message "output" (what I like to call "chatter"). This output (such as that printed below the `library(tidyverse)` chunk above) is completely normal. But if you're loading a library in a quarto document, you might want to hide the message output in the resulting rendered document. To do that, you can use the chunk option `#| message: false`, as in:

```
```{r}
#| message: false
library(dplyr)
```
```

Then the library loading "chatter" will be hidden from the rendered HTML document.

## 6.2 Tibbles and the `read_csv()` function

In the last chapter, we used a "base R" function (`read.csv()`) to load our gapminder dataset. The term "*base R*" refers to functions that are always available in R and do not require you to load any additional libraries.

While it's perfectly fine to continue to use this `read.csv()` function, I recommend instead using a slightly different function that has an underscore instead of a period in its name: `read_csv()`. This function does pretty much the same thing as `read.csv()` but it is part of the tidyverse and is a little bit more efficient and user-friendly than `read.csv()`.

Let's use `read_csv()` (the tidyverse version of `read.csv()`) to load the gapminder dataset:

```
gapminder <- read_csv("data/gapminder.csv")
```

```
Rows: 1704 Columns: 6
-- Column specification -----
Delimiter: ","
chr (2): country, continent
dbl (4): year, lifeExp, pop, gdpPercap

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

This function also tends to print out some “chatter” message text, which I can hide from my rendered quarto output by providing the `#| message: false` chunk option at the top of the relevant code chunk.

If you ran this in your own console and you got an error saying “*Error in read\_csv("data/gapminder.csv") : could not find function "read\_csv"*”, make sure you have installed the tidyverse *and have run the code library(tidyverse) in your console!* R can only find the `read_csv()` function if you have loaded the tidyverse!

Now let’s take a look at `gapminder` (*without using head()*)

```
gapminder
```

```
# A tibble: 1,704 x 6
  country   continent   year lifeExp     pop gdpPercap
  <chr>     <chr>      <dbl>   <dbl>     <dbl>       <dbl>
1 Afghanistan Asia      1952    28.8  8425333     779.
2 Afghanistan Asia      1957    30.3  9240934     821.
3 Afghanistan Asia      1962    32.0  10267083    853.
4 Afghanistan Asia      1967    34.0  11537966    836.
5 Afghanistan Asia      1972    36.1  13079460    740.
6 Afghanistan Asia      1977    38.4  14880372    786.
7 Afghanistan Asia      1982    39.9  12881816    978.
8 Afghanistan Asia      1987    40.8  13867957    852.
9 Afghanistan Asia      1992    41.7  16317921    649.
10 Afghanistan Asia     1997    41.8  22227415    635.
# i 1,694 more rows
```

Do you notice any differences between this version of `gapminder` (that has been loaded using the tidyverse `read_csv()`) and the version from the previous chapter (that was loaded using the base R `read.csv()` function)?

To make your life easier, here is the version of `gapminder` that we loaded with the base R `read.csv()` function:

```
gapminder_base_r <- read.csv("data/gapminder.csv")
gapminder_base_r
```

|   | country     | continent | year | lifeExp  | pop      | gdpPercap |
|---|-------------|-----------|------|----------|----------|-----------|
| 1 | Afghanistan | Asia      | 1952 | 28.80100 | 8425333  | 779.4453  |
| 2 | Afghanistan | Asia      | 1957 | 30.33200 | 9240934  | 820.8530  |
| 3 | Afghanistan | Asia      | 1962 | 31.99700 | 10267083 | 853.1007  |

|    |             |        |      |          |          |           |
|----|-------------|--------|------|----------|----------|-----------|
| 4  | Afghanistan | Asia   | 1967 | 34.02000 | 11537966 | 836.1971  |
| 5  | Afghanistan | Asia   | 1972 | 36.08800 | 13079460 | 739.9811  |
| 6  | Afghanistan | Asia   | 1977 | 38.43800 | 14880372 | 786.1134  |
| 7  | Afghanistan | Asia   | 1982 | 39.85400 | 12881816 | 978.0114  |
| 8  | Afghanistan | Asia   | 1987 | 40.82200 | 13867957 | 852.3959  |
| 9  | Afghanistan | Asia   | 1992 | 41.67400 | 16317921 | 649.3414  |
| 10 | Afghanistan | Asia   | 1997 | 41.76300 | 22227415 | 635.3414  |
| 11 | Afghanistan | Asia   | 2002 | 42.12900 | 25268405 | 726.7341  |
| 12 | Afghanistan | Asia   | 2007 | 43.82800 | 31889923 | 974.5803  |
| 13 | Albania     | Europe | 1952 | 55.23000 | 1282697  | 1601.0561 |
| 14 | Albania     | Europe | 1957 | 59.28000 | 1476505  | 1942.2842 |
| 15 | Albania     | Europe | 1962 | 64.82000 | 1728137  | 2312.8890 |
| 16 | Albania     | Europe | 1967 | 66.22000 | 1984060  | 2760.1969 |
| 17 | Albania     | Europe | 1972 | 67.69000 | 2263554  | 3313.4222 |
| 18 | Albania     | Europe | 1977 | 68.93000 | 2509048  | 3533.0039 |
| 19 | Albania     | Europe | 1982 | 70.42000 | 2780097  | 3630.8807 |
| 20 | Albania     | Europe | 1987 | 72.00000 | 3075321  | 3738.9327 |
| 21 | Albania     | Europe | 1992 | 71.58100 | 3326498  | 2497.4379 |
| 22 | Albania     | Europe | 1997 | 72.95000 | 3428038  | 3193.0546 |
| 23 | Albania     | Europe | 2002 | 75.65100 | 3508512  | 4604.2117 |
| 24 | Albania     | Europe | 2007 | 76.42300 | 3600523  | 5937.0295 |
| 25 | Algeria     | Africa | 1952 | 43.07700 | 9279525  | 2449.0082 |
| 26 | Algeria     | Africa | 1957 | 45.68500 | 10270856 | 3013.9760 |
| 27 | Algeria     | Africa | 1962 | 48.30300 | 11000948 | 2550.8169 |
| 28 | Algeria     | Africa | 1967 | 51.40700 | 12760499 | 3246.9918 |
| 29 | Algeria     | Africa | 1972 | 54.51800 | 14760787 | 4182.6638 |
| 30 | Algeria     | Africa | 1977 | 58.01400 | 17152804 | 4910.4168 |
| 31 | Algeria     | Africa | 1982 | 61.36800 | 20033753 | 5745.1602 |
| 32 | Algeria     | Africa | 1987 | 65.79900 | 23254956 | 5681.3585 |
| 33 | Algeria     | Africa | 1992 | 67.74400 | 26298373 | 5023.2166 |
| 34 | Algeria     | Africa | 1997 | 69.15200 | 29072015 | 4797.2951 |
| 35 | Algeria     | Africa | 2002 | 70.99400 | 31287142 | 5288.0404 |
| 36 | Algeria     | Africa | 2007 | 72.30100 | 33333216 | 6223.3675 |
| 37 | Angola      | Africa | 1952 | 30.01500 | 4232095  | 3520.6103 |
| 38 | Angola      | Africa | 1957 | 31.99900 | 4561361  | 3827.9405 |
| 39 | Angola      | Africa | 1962 | 34.00000 | 4826015  | 4269.2767 |
| 40 | Angola      | Africa | 1967 | 35.98500 | 5247469  | 5522.7764 |
| 41 | Angola      | Africa | 1972 | 37.92800 | 5894858  | 5473.2880 |
| 42 | Angola      | Africa | 1977 | 39.48300 | 6162675  | 3008.6474 |
| 43 | Angola      | Africa | 1982 | 39.94200 | 7016384  | 2756.9537 |
| 44 | Angola      | Africa | 1987 | 39.90600 | 7874230  | 2430.2083 |
| 45 | Angola      | Africa | 1992 | 40.64700 | 8735988  | 2627.8457 |
| 46 | Angola      | Africa | 1997 | 40.96300 | 9875024  | 2277.1409 |

|    |           |          |      |          |          |            |
|----|-----------|----------|------|----------|----------|------------|
| 47 | Angola    | Africa   | 2002 | 41.00300 | 10866106 | 2773.2873  |
| 48 | Angola    | Africa   | 2007 | 42.73100 | 12420476 | 4797.2313  |
| 49 | Argentina | Americas | 1952 | 62.48500 | 17876956 | 5911.3151  |
| 50 | Argentina | Americas | 1957 | 64.39900 | 19610538 | 6856.8562  |
| 51 | Argentina | Americas | 1962 | 65.14200 | 21283783 | 7133.1660  |
| 52 | Argentina | Americas | 1967 | 65.63400 | 22934225 | 8052.9530  |
| 53 | Argentina | Americas | 1972 | 67.06500 | 24779799 | 9443.0385  |
| 54 | Argentina | Americas | 1977 | 68.48100 | 26983828 | 10079.0267 |
| 55 | Argentina | Americas | 1982 | 69.94200 | 29341374 | 8997.8974  |
| 56 | Argentina | Americas | 1987 | 70.77400 | 31620918 | 9139.6714  |
| 57 | Argentina | Americas | 1992 | 71.86800 | 33958947 | 9308.4187  |
| 58 | Argentina | Americas | 1997 | 73.27500 | 36203463 | 10967.2820 |
| 59 | Argentina | Americas | 2002 | 74.34000 | 38331121 | 8797.6407  |
| 60 | Argentina | Americas | 2007 | 75.32000 | 40301927 | 12779.3796 |
| 61 | Australia | Oceania  | 1952 | 69.12000 | 8691212  | 10039.5956 |
| 62 | Australia | Oceania  | 1957 | 70.33000 | 9712569  | 10949.6496 |
| 63 | Australia | Oceania  | 1962 | 70.93000 | 10794968 | 12217.2269 |
| 64 | Australia | Oceania  | 1967 | 71.10000 | 11872264 | 14526.1246 |
| 65 | Australia | Oceania  | 1972 | 71.93000 | 13177000 | 16788.6295 |
| 66 | Australia | Oceania  | 1977 | 73.49000 | 14074100 | 18334.1975 |
| 67 | Australia | Oceania  | 1982 | 74.74000 | 15184200 | 19477.0093 |
| 68 | Australia | Oceania  | 1987 | 76.32000 | 16257249 | 21888.8890 |
| 69 | Australia | Oceania  | 1992 | 77.56000 | 17481977 | 23424.7668 |
| 70 | Australia | Oceania  | 1997 | 78.83000 | 18565243 | 26997.9366 |
| 71 | Australia | Oceania  | 2002 | 80.37000 | 19546792 | 30687.7547 |
| 72 | Australia | Oceania  | 2007 | 81.23500 | 20434176 | 34435.3674 |
| 73 | Austria   | Europe   | 1952 | 66.80000 | 6927772  | 6137.0765  |
| 74 | Austria   | Europe   | 1957 | 67.48000 | 6965860  | 8842.5980  |
| 75 | Austria   | Europe   | 1962 | 69.54000 | 7129864  | 10750.7211 |
| 76 | Austria   | Europe   | 1967 | 70.14000 | 7376998  | 12834.6024 |
| 77 | Austria   | Europe   | 1972 | 70.63000 | 7544201  | 16661.6256 |
| 78 | Austria   | Europe   | 1977 | 72.17000 | 7568430  | 19749.4223 |
| 79 | Austria   | Europe   | 1982 | 73.18000 | 7574613  | 21597.0836 |
| 80 | Austria   | Europe   | 1987 | 74.94000 | 7578903  | 23687.8261 |
| 81 | Austria   | Europe   | 1992 | 76.04000 | 7914969  | 27042.0187 |
| 82 | Austria   | Europe   | 1997 | 77.51000 | 8069876  | 29095.9207 |
| 83 | Austria   | Europe   | 2002 | 78.98000 | 8148312  | 32417.6077 |
| 84 | Austria   | Europe   | 2007 | 79.82900 | 8199783  | 36126.4927 |
| 85 | Bahrain   | Asia     | 1952 | 50.93900 | 120447   | 9867.0848  |
| 86 | Bahrain   | Asia     | 1957 | 53.83200 | 138655   | 11635.7995 |
| 87 | Bahrain   | Asia     | 1962 | 56.92300 | 171863   | 12753.2751 |
| 88 | Bahrain   | Asia     | 1967 | 59.92300 | 202182   | 14804.6727 |
| 89 | Bahrain   | Asia     | 1972 | 63.30000 | 230800   | 18268.6584 |

|     |            |        |      |          |           |            |
|-----|------------|--------|------|----------|-----------|------------|
| 90  | Bahrain    | Asia   | 1977 | 65.59300 | 297410    | 19340.1020 |
| 91  | Bahrain    | Asia   | 1982 | 69.05200 | 377967    | 19211.1473 |
| 92  | Bahrain    | Asia   | 1987 | 70.75000 | 454612    | 18524.0241 |
| 93  | Bahrain    | Asia   | 1992 | 72.60100 | 529491    | 19035.5792 |
| 94  | Bahrain    | Asia   | 1997 | 73.92500 | 598561    | 20292.0168 |
| 95  | Bahrain    | Asia   | 2002 | 74.79500 | 656397    | 23403.5593 |
| 96  | Bahrain    | Asia   | 2007 | 75.63500 | 708573    | 29796.0483 |
| 97  | Bangladesh | Asia   | 1952 | 37.48400 | 46886859  | 684.2442   |
| 98  | Bangladesh | Asia   | 1957 | 39.34800 | 51365468  | 661.6375   |
| 99  | Bangladesh | Asia   | 1962 | 41.21600 | 56839289  | 686.3416   |
| 100 | Bangladesh | Asia   | 1967 | 43.45300 | 62821884  | 721.1861   |
| 101 | Bangladesh | Asia   | 1972 | 45.25200 | 70759295  | 630.2336   |
| 102 | Bangladesh | Asia   | 1977 | 46.92300 | 80428306  | 659.8772   |
| 103 | Bangladesh | Asia   | 1982 | 50.00900 | 93074406  | 676.9819   |
| 104 | Bangladesh | Asia   | 1987 | 52.81900 | 103764241 | 751.9794   |
| 105 | Bangladesh | Asia   | 1992 | 56.01800 | 113704579 | 837.8102   |
| 106 | Bangladesh | Asia   | 1997 | 59.41200 | 123315288 | 972.7700   |
| 107 | Bangladesh | Asia   | 2002 | 62.01300 | 135656790 | 1136.3904  |
| 108 | Bangladesh | Asia   | 2007 | 64.06200 | 150448339 | 1391.2538  |
| 109 | Belgium    | Europe | 1952 | 68.00000 | 8730405   | 8343.1051  |
| 110 | Belgium    | Europe | 1957 | 69.24000 | 8989111   | 9714.9606  |
| 111 | Belgium    | Europe | 1962 | 70.25000 | 9218400   | 10991.2068 |
| 112 | Belgium    | Europe | 1967 | 70.94000 | 9556500   | 13149.0412 |
| 113 | Belgium    | Europe | 1972 | 71.44000 | 9709100   | 16672.1436 |
| 114 | Belgium    | Europe | 1977 | 72.80000 | 9821800   | 19117.9745 |
| 115 | Belgium    | Europe | 1982 | 73.93000 | 9856303   | 20979.8459 |
| 116 | Belgium    | Europe | 1987 | 75.35000 | 9870200   | 22525.5631 |
| 117 | Belgium    | Europe | 1992 | 76.46000 | 10045622  | 25575.5707 |
| 118 | Belgium    | Europe | 1997 | 77.53000 | 10199787  | 27561.1966 |
| 119 | Belgium    | Europe | 2002 | 78.32000 | 10311970  | 30485.8838 |
| 120 | Belgium    | Europe | 2007 | 79.44100 | 10392226  | 33692.6051 |
| 121 | Benin      | Africa | 1952 | 38.22300 | 1738315   | 1062.7522  |
| 122 | Benin      | Africa | 1957 | 40.35800 | 1925173   | 959.6011   |
| 123 | Benin      | Africa | 1962 | 42.61800 | 2151895   | 949.4991   |
| 124 | Benin      | Africa | 1967 | 44.88500 | 2427334   | 1035.8314  |
| 125 | Benin      | Africa | 1972 | 47.01400 | 2761407   | 1085.7969  |
| 126 | Benin      | Africa | 1977 | 49.19000 | 3168267   | 1029.1613  |
| 127 | Benin      | Africa | 1982 | 50.90400 | 3641603   | 1277.8976  |
| 128 | Benin      | Africa | 1987 | 52.33700 | 4243788   | 1225.8560  |
| 129 | Benin      | Africa | 1992 | 53.91900 | 4981671   | 1191.2077  |
| 130 | Benin      | Africa | 1997 | 54.77700 | 6066080   | 1232.9753  |
| 131 | Benin      | Africa | 2002 | 54.40600 | 7026113   | 1372.8779  |
| 132 | Benin      | Africa | 2007 | 56.72800 | 8078314   | 1441.2849  |

|     |                        |          |      |          |           |            |
|-----|------------------------|----------|------|----------|-----------|------------|
| 133 | Bolivia                | Americas | 1952 | 40.41400 | 2883315   | 2677.3263  |
| 134 | Bolivia                | Americas | 1957 | 41.89000 | 3211738   | 2127.6863  |
| 135 | Bolivia                | Americas | 1962 | 43.42800 | 3593918   | 2180.9725  |
| 136 | Bolivia                | Americas | 1967 | 45.03200 | 4040665   | 2586.8861  |
| 137 | Bolivia                | Americas | 1972 | 46.71400 | 4565872   | 2980.3313  |
| 138 | Bolivia                | Americas | 1977 | 50.02300 | 5079716   | 3548.0978  |
| 139 | Bolivia                | Americas | 1982 | 53.85900 | 5642224   | 3156.5105  |
| 140 | Bolivia                | Americas | 1987 | 57.25100 | 6156369   | 2753.6915  |
| 141 | Bolivia                | Americas | 1992 | 59.95700 | 6893451   | 2961.6997  |
| 142 | Bolivia                | Americas | 1997 | 62.05000 | 7693188   | 3326.1432  |
| 143 | Bolivia                | Americas | 2002 | 63.88300 | 8445134   | 3413.2627  |
| 144 | Bolivia                | Americas | 2007 | 65.55400 | 9119152   | 3822.1371  |
| 145 | Bosnia and Herzegovina | Europe   | 1952 | 53.82000 | 2791000   | 973.5332   |
| 146 | Bosnia and Herzegovina | Europe   | 1957 | 58.45000 | 3076000   | 1353.9892  |
| 147 | Bosnia and Herzegovina | Europe   | 1962 | 61.93000 | 3349000   | 1709.6837  |
| 148 | Bosnia and Herzegovina | Europe   | 1967 | 64.79000 | 3585000   | 2172.3524  |
| 149 | Bosnia and Herzegovina | Europe   | 1972 | 67.45000 | 3819000   | 2860.1698  |
| 150 | Bosnia and Herzegovina | Europe   | 1977 | 69.86000 | 4086000   | 3528.4813  |
| 151 | Bosnia and Herzegovina | Europe   | 1982 | 70.69000 | 4172693   | 4126.6132  |
| 152 | Bosnia and Herzegovina | Europe   | 1987 | 71.14000 | 4338977   | 4314.1148  |
| 153 | Bosnia and Herzegovina | Europe   | 1992 | 72.17800 | 4256013   | 2546.7814  |
| 154 | Bosnia and Herzegovina | Europe   | 1997 | 73.24400 | 3607000   | 4766.3559  |
| 155 | Bosnia and Herzegovina | Europe   | 2002 | 74.09000 | 4165416   | 6018.9752  |
| 156 | Bosnia and Herzegovina | Europe   | 2007 | 74.85200 | 4552198   | 7446.2988  |
| 157 | Botswana               | Africa   | 1952 | 47.62200 | 442308    | 851.2411   |
| 158 | Botswana               | Africa   | 1957 | 49.61800 | 474639    | 918.2325   |
| 159 | Botswana               | Africa   | 1962 | 51.52000 | 512764    | 983.6540   |
| 160 | Botswana               | Africa   | 1967 | 53.29800 | 553541    | 1214.7093  |
| 161 | Botswana               | Africa   | 1972 | 56.02400 | 619351    | 2263.6111  |
| 162 | Botswana               | Africa   | 1977 | 59.31900 | 781472    | 3214.8578  |
| 163 | Botswana               | Africa   | 1982 | 61.48400 | 970347    | 4551.1421  |
| 164 | Botswana               | Africa   | 1987 | 63.62200 | 1151184   | 6205.8839  |
| 165 | Botswana               | Africa   | 1992 | 62.74500 | 1342614   | 7954.1116  |
| 166 | Botswana               | Africa   | 1997 | 52.55600 | 1536536   | 8647.1423  |
| 167 | Botswana               | Africa   | 2002 | 46.63400 | 1630347   | 11003.6051 |
| 168 | Botswana               | Africa   | 2007 | 50.72800 | 1639131   | 12569.8518 |
| 169 | Brazil                 | Americas | 1952 | 50.91700 | 56602560  | 2108.9444  |
| 170 | Brazil                 | Americas | 1957 | 53.28500 | 65551171  | 2487.3660  |
| 171 | Brazil                 | Americas | 1962 | 55.66500 | 76039390  | 3336.5858  |
| 172 | Brazil                 | Americas | 1967 | 57.63200 | 88049823  | 3429.8644  |
| 173 | Brazil                 | Americas | 1972 | 59.50400 | 100840058 | 4985.7115  |
| 174 | Brazil                 | Americas | 1977 | 61.48900 | 114313951 | 6660.1187  |
| 175 | Brazil                 | Americas | 1982 | 63.33600 | 128962939 | 7030.8359  |

|     |              |          |      |          |           |            |
|-----|--------------|----------|------|----------|-----------|------------|
| 176 | Brazil       | Americas | 1987 | 65.20500 | 142938076 | 7807.0958  |
| 177 | Brazil       | Americas | 1992 | 67.05700 | 155975974 | 6950.2830  |
| 178 | Brazil       | Americas | 1997 | 69.38800 | 168546719 | 7957.9808  |
| 179 | Brazil       | Americas | 2002 | 71.00600 | 179914212 | 8131.2128  |
| 180 | Brazil       | Americas | 2007 | 72.39000 | 190010647 | 9065.8008  |
| 181 | Bulgaria     | Europe   | 1952 | 59.60000 | 7274900   | 2444.2866  |
| 182 | Bulgaria     | Europe   | 1957 | 66.61000 | 7651254   | 3008.6707  |
| 183 | Bulgaria     | Europe   | 1962 | 69.51000 | 8012946   | 4254.3378  |
| 184 | Bulgaria     | Europe   | 1967 | 70.42000 | 8310226   | 5577.0028  |
| 185 | Bulgaria     | Europe   | 1972 | 70.90000 | 8576200   | 6597.4944  |
| 186 | Bulgaria     | Europe   | 1977 | 70.81000 | 8797022   | 7612.2404  |
| 187 | Bulgaria     | Europe   | 1982 | 71.08000 | 8892098   | 8224.1916  |
| 188 | Bulgaria     | Europe   | 1987 | 71.34000 | 8971958   | 8239.8548  |
| 189 | Bulgaria     | Europe   | 1992 | 71.19000 | 8658506   | 6302.6234  |
| 190 | Bulgaria     | Europe   | 1997 | 70.32000 | 8066057   | 5970.3888  |
| 191 | Bulgaria     | Europe   | 2002 | 72.14000 | 7661799   | 7696.7777  |
| 192 | Bulgaria     | Europe   | 2007 | 73.00500 | 7322858   | 10680.7928 |
| 193 | Burkina Faso | Africa   | 1952 | 31.97500 | 4469979   | 543.2552   |
| 194 | Burkina Faso | Africa   | 1957 | 34.90600 | 4713416   | 617.1835   |
| 195 | Burkina Faso | Africa   | 1962 | 37.81400 | 4919632   | 722.5120   |
| 196 | Burkina Faso | Africa   | 1967 | 40.69700 | 5127935   | 794.8266   |
| 197 | Burkina Faso | Africa   | 1972 | 43.59100 | 5433886   | 854.7360   |
| 198 | Burkina Faso | Africa   | 1977 | 46.13700 | 5889574   | 743.3870   |
| 199 | Burkina Faso | Africa   | 1982 | 48.12200 | 6634596   | 807.1986   |
| 200 | Burkina Faso | Africa   | 1987 | 49.55700 | 7586551   | 912.0631   |
| 201 | Burkina Faso | Africa   | 1992 | 50.26000 | 8878303   | 931.7528   |
| 202 | Burkina Faso | Africa   | 1997 | 50.32400 | 10352843  | 946.2950   |
| 203 | Burkina Faso | Africa   | 2002 | 50.65000 | 12251209  | 1037.6452  |
| 204 | Burkina Faso | Africa   | 2007 | 52.29500 | 14326203  | 1217.0330  |
| 205 | Burundi      | Africa   | 1952 | 39.03100 | 2445618   | 339.2965   |
| 206 | Burundi      | Africa   | 1957 | 40.53300 | 2667518   | 379.5646   |
| 207 | Burundi      | Africa   | 1962 | 42.04500 | 2961915   | 355.2032   |
| 208 | Burundi      | Africa   | 1967 | 43.54800 | 3330989   | 412.9775   |
| 209 | Burundi      | Africa   | 1972 | 44.05700 | 3529983   | 464.0995   |
| 210 | Burundi      | Africa   | 1977 | 45.91000 | 3834415   | 556.1033   |
| 211 | Burundi      | Africa   | 1982 | 47.47100 | 4580410   | 559.6032   |
| 212 | Burundi      | Africa   | 1987 | 48.21100 | 5126023   | 621.8188   |
| 213 | Burundi      | Africa   | 1992 | 44.73600 | 5809236   | 631.6999   |
| 214 | Burundi      | Africa   | 1997 | 45.32600 | 6121610   | 463.1151   |
| 215 | Burundi      | Africa   | 2002 | 47.36000 | 7021078   | 446.4035   |
| 216 | Burundi      | Africa   | 2007 | 49.58000 | 8390505   | 430.0707   |
| 217 | Cambodia     | Asia     | 1952 | 39.41700 | 4693836   | 368.4693   |
| 218 | Cambodia     | Asia     | 1957 | 41.36600 | 5322536   | 434.0383   |

|     |                          |          |      |          |          |            |
|-----|--------------------------|----------|------|----------|----------|------------|
| 219 | Cambodia                 | Asia     | 1962 | 43.41500 | 6083619  | 496.9136   |
| 220 | Cambodia                 | Asia     | 1967 | 45.41500 | 6960067  | 523.4323   |
| 221 | Cambodia                 | Asia     | 1972 | 40.31700 | 7450606  | 421.6240   |
| 222 | Cambodia                 | Asia     | 1977 | 31.22000 | 6978607  | 524.9722   |
| 223 | Cambodia                 | Asia     | 1982 | 50.95700 | 7272485  | 624.4755   |
| 224 | Cambodia                 | Asia     | 1987 | 53.91400 | 8371791  | 683.8956   |
| 225 | Cambodia                 | Asia     | 1992 | 55.80300 | 10150094 | 682.3032   |
| 226 | Cambodia                 | Asia     | 1997 | 56.53400 | 11782962 | 734.2852   |
| 227 | Cambodia                 | Asia     | 2002 | 56.75200 | 12926707 | 896.2260   |
| 228 | Cambodia                 | Asia     | 2007 | 59.72300 | 14131858 | 1713.7787  |
| 229 | Cameroon                 | Africa   | 1952 | 38.52300 | 5009067  | 1172.6677  |
| 230 | Cameroon                 | Africa   | 1957 | 40.42800 | 5359923  | 1313.0481  |
| 231 | Cameroon                 | Africa   | 1962 | 42.64300 | 5793633  | 1399.6074  |
| 232 | Cameroon                 | Africa   | 1967 | 44.79900 | 6335506  | 1508.4531  |
| 233 | Cameroon                 | Africa   | 1972 | 47.04900 | 7021028  | 1684.1465  |
| 234 | Cameroon                 | Africa   | 1977 | 49.35500 | 7959865  | 1783.4329  |
| 235 | Cameroon                 | Africa   | 1982 | 52.96100 | 9250831  | 2367.9833  |
| 236 | Cameroon                 | Africa   | 1987 | 54.98500 | 10780667 | 2602.6642  |
| 237 | Cameroon                 | Africa   | 1992 | 54.31400 | 12467171 | 1793.1633  |
| 238 | Cameroon                 | Africa   | 1997 | 52.19900 | 14195809 | 1694.3375  |
| 239 | Cameroon                 | Africa   | 2002 | 49.85600 | 15929988 | 1934.0114  |
| 240 | Cameroon                 | Africa   | 2007 | 50.43000 | 17696293 | 2042.0952  |
| 241 | Canada                   | Americas | 1952 | 68.75000 | 14785584 | 11367.1611 |
| 242 | Canada                   | Americas | 1957 | 69.96000 | 17010154 | 12489.9501 |
| 243 | Canada                   | Americas | 1962 | 71.30000 | 18985849 | 13462.4855 |
| 244 | Canada                   | Americas | 1967 | 72.13000 | 20819767 | 16076.5880 |
| 245 | Canada                   | Americas | 1972 | 72.88000 | 22284500 | 18970.5709 |
| 246 | Canada                   | Americas | 1977 | 74.21000 | 23796400 | 22090.8831 |
| 247 | Canada                   | Americas | 1982 | 75.76000 | 25201900 | 22898.7921 |
| 248 | Canada                   | Americas | 1987 | 76.86000 | 26549700 | 26626.5150 |
| 249 | Canada                   | Americas | 1992 | 77.95000 | 28523502 | 26342.8843 |
| 250 | Canada                   | Americas | 1997 | 78.61000 | 30305843 | 28954.9259 |
| 251 | Canada                   | Americas | 2002 | 79.77000 | 31902268 | 33328.9651 |
| 252 | Canada                   | Americas | 2007 | 80.65300 | 33390141 | 36319.2350 |
| 253 | Central African Republic | Africa   | 1952 | 35.46300 | 1291695  | 1071.3107  |
| 254 | Central African Republic | Africa   | 1957 | 37.46400 | 1392284  | 1190.8443  |
| 255 | Central African Republic | Africa   | 1962 | 39.47500 | 1523478  | 1193.0688  |
| 256 | Central African Republic | Africa   | 1967 | 41.47800 | 1733638  | 1136.0566  |
| 257 | Central African Republic | Africa   | 1972 | 43.45700 | 1927260  | 1070.0133  |
| 258 | Central African Republic | Africa   | 1977 | 46.77500 | 2167533  | 1109.3743  |
| 259 | Central African Republic | Africa   | 1982 | 48.29500 | 2476971  | 956.7530   |
| 260 | Central African Republic | Africa   | 1987 | 50.48500 | 2840009  | 844.8764   |
| 261 | Central African Republic | Africa   | 1992 | 49.39600 | 3265124  | 747.9055   |

|     |                          |          |      |          |            |            |
|-----|--------------------------|----------|------|----------|------------|------------|
| 262 | Central African Republic | Africa   | 1997 | 46.06600 | 3696513    | 740.5063   |
| 263 | Central African Republic | Africa   | 2002 | 43.30800 | 4048013    | 738.6906   |
| 264 | Central African Republic | Africa   | 2007 | 44.74100 | 4369038    | 706.0165   |
| 265 | Chad                     | Africa   | 1952 | 38.09200 | 2682462    | 1178.6659  |
| 266 | Chad                     | Africa   | 1957 | 39.88100 | 2894855    | 1308.4956  |
| 267 | Chad                     | Africa   | 1962 | 41.71600 | 3150417    | 1389.8176  |
| 268 | Chad                     | Africa   | 1967 | 43.60100 | 3495967    | 1196.8106  |
| 269 | Chad                     | Africa   | 1972 | 45.56900 | 3899068    | 1104.1040  |
| 270 | Chad                     | Africa   | 1977 | 47.38300 | 4388260    | 1133.9850  |
| 271 | Chad                     | Africa   | 1982 | 49.51700 | 4875118    | 797.9081   |
| 272 | Chad                     | Africa   | 1987 | 51.05100 | 5498955    | 952.3861   |
| 273 | Chad                     | Africa   | 1992 | 51.72400 | 6429417    | 1058.0643  |
| 274 | Chad                     | Africa   | 1997 | 51.57300 | 7562011    | 1004.9614  |
| 275 | Chad                     | Africa   | 2002 | 50.52500 | 8835739    | 1156.1819  |
| 276 | Chad                     | Africa   | 2007 | 50.65100 | 10238807   | 1704.0637  |
| 277 | Chile                    | Americas | 1952 | 54.74500 | 6377619    | 3939.9788  |
| 278 | Chile                    | Americas | 1957 | 56.07400 | 7048426    | 4315.6227  |
| 279 | Chile                    | Americas | 1962 | 57.92400 | 7961258    | 4519.0943  |
| 280 | Chile                    | Americas | 1967 | 60.52300 | 8858908    | 5106.6543  |
| 281 | Chile                    | Americas | 1972 | 63.44100 | 9717524    | 5494.0244  |
| 282 | Chile                    | Americas | 1977 | 67.05200 | 10599793   | 4756.7638  |
| 283 | Chile                    | Americas | 1982 | 70.56500 | 11487112   | 5095.6657  |
| 284 | Chile                    | Americas | 1987 | 72.49200 | 12463354   | 5547.0638  |
| 285 | Chile                    | Americas | 1992 | 74.12600 | 13572994   | 7596.1260  |
| 286 | Chile                    | Americas | 1997 | 75.81600 | 14599929   | 10118.0532 |
| 287 | Chile                    | Americas | 2002 | 77.86000 | 15497046   | 10778.7838 |
| 288 | Chile                    | Americas | 2007 | 78.55300 | 16284741   | 13171.6388 |
| 289 | China                    | Asia     | 1952 | 44.00000 | 556263527  | 400.4486   |
| 290 | China                    | Asia     | 1957 | 50.54896 | 637408000  | 575.9870   |
| 291 | China                    | Asia     | 1962 | 44.50136 | 665770000  | 487.6740   |
| 292 | China                    | Asia     | 1967 | 58.38112 | 754550000  | 612.7057   |
| 293 | China                    | Asia     | 1972 | 63.11888 | 862030000  | 676.9001   |
| 294 | China                    | Asia     | 1977 | 63.96736 | 943455000  | 741.2375   |
| 295 | China                    | Asia     | 1982 | 65.52500 | 1000281000 | 962.4214   |
| 296 | China                    | Asia     | 1987 | 67.27400 | 1084035000 | 1378.9040  |
| 297 | China                    | Asia     | 1992 | 68.69000 | 1164970000 | 1655.7842  |
| 298 | China                    | Asia     | 1997 | 70.42600 | 1230075000 | 2289.2341  |
| 299 | China                    | Asia     | 2002 | 72.02800 | 1280400000 | 3119.2809  |
| 300 | China                    | Asia     | 2007 | 72.96100 | 1318683096 | 4959.1149  |
| 301 | Colombia                 | Americas | 1952 | 50.64300 | 12350771   | 2144.1151  |
| 302 | Colombia                 | Americas | 1957 | 55.11800 | 14485993   | 2323.8056  |
| 303 | Colombia                 | Americas | 1962 | 57.86300 | 17009885   | 2492.3511  |
| 304 | Colombia                 | Americas | 1967 | 59.96300 | 19764027   | 2678.7298  |

|     |                  |          |      |          |          |           |
|-----|------------------|----------|------|----------|----------|-----------|
| 305 | Colombia         | Americas | 1972 | 61.62300 | 22542890 | 3264.6600 |
| 306 | Colombia         | Americas | 1977 | 63.83700 | 25094412 | 3815.8079 |
| 307 | Colombia         | Americas | 1982 | 66.65300 | 27764644 | 4397.5757 |
| 308 | Colombia         | Americas | 1987 | 67.76800 | 30964245 | 4903.2191 |
| 309 | Colombia         | Americas | 1992 | 68.42100 | 34202721 | 5444.6486 |
| 310 | Colombia         | Americas | 1997 | 70.31300 | 37657830 | 6117.3617 |
| 311 | Colombia         | Americas | 2002 | 71.68200 | 41008227 | 5755.2600 |
| 312 | Colombia         | Americas | 2007 | 72.88900 | 44227550 | 7006.5804 |
| 313 | Comoros          | Africa   | 1952 | 40.71500 | 153936   | 1102.9909 |
| 314 | Comoros          | Africa   | 1957 | 42.46000 | 170928   | 1211.1485 |
| 315 | Comoros          | Africa   | 1962 | 44.46700 | 191689   | 1406.6483 |
| 316 | Comoros          | Africa   | 1967 | 46.47200 | 217378   | 1876.0296 |
| 317 | Comoros          | Africa   | 1972 | 48.94400 | 250027   | 1937.5777 |
| 318 | Comoros          | Africa   | 1977 | 50.93900 | 304739   | 1172.6030 |
| 319 | Comoros          | Africa   | 1982 | 52.93300 | 348643   | 1267.1001 |
| 320 | Comoros          | Africa   | 1987 | 54.92600 | 395114   | 1315.9808 |
| 321 | Comoros          | Africa   | 1992 | 57.93900 | 454429   | 1246.9074 |
| 322 | Comoros          | Africa   | 1997 | 60.66000 | 527982   | 1173.6182 |
| 323 | Comoros          | Africa   | 2002 | 62.97400 | 614382   | 1075.8116 |
| 324 | Comoros          | Africa   | 2007 | 65.15200 | 710960   | 986.1479  |
| 325 | Congo, Dem. Rep. | Africa   | 1952 | 39.14300 | 14100005 | 780.5423  |
| 326 | Congo, Dem. Rep. | Africa   | 1957 | 40.65200 | 15577932 | 905.8602  |
| 327 | Congo, Dem. Rep. | Africa   | 1962 | 42.12200 | 17486434 | 896.3146  |
| 328 | Congo, Dem. Rep. | Africa   | 1967 | 44.05600 | 19941073 | 861.5932  |
| 329 | Congo, Dem. Rep. | Africa   | 1972 | 45.98900 | 23007669 | 904.8961  |
| 330 | Congo, Dem. Rep. | Africa   | 1977 | 47.80400 | 26480870 | 795.7573  |
| 331 | Congo, Dem. Rep. | Africa   | 1982 | 47.78400 | 30646495 | 673.7478  |
| 332 | Congo, Dem. Rep. | Africa   | 1987 | 47.41200 | 35481645 | 672.7748  |
| 333 | Congo, Dem. Rep. | Africa   | 1992 | 45.54800 | 41672143 | 457.7192  |
| 334 | Congo, Dem. Rep. | Africa   | 1997 | 42.58700 | 47798986 | 312.1884  |
| 335 | Congo, Dem. Rep. | Africa   | 2002 | 44.96600 | 55379852 | 241.1659  |
| 336 | Congo, Dem. Rep. | Africa   | 2007 | 46.46200 | 64606759 | 277.5519  |
| 337 | Congo, Rep.      | Africa   | 1952 | 42.11100 | 854885   | 2125.6214 |
| 338 | Congo, Rep.      | Africa   | 1957 | 45.05300 | 940458   | 2315.0566 |
| 339 | Congo, Rep.      | Africa   | 1962 | 48.43500 | 1047924  | 2464.7832 |
| 340 | Congo, Rep.      | Africa   | 1967 | 52.04000 | 1179760  | 2677.9396 |
| 341 | Congo, Rep.      | Africa   | 1972 | 54.90700 | 1340458  | 3213.1527 |
| 342 | Congo, Rep.      | Africa   | 1977 | 55.62500 | 1536769  | 3259.1790 |
| 343 | Congo, Rep.      | Africa   | 1982 | 56.69500 | 1774735  | 4879.5075 |
| 344 | Congo, Rep.      | Africa   | 1987 | 57.47000 | 2064095  | 4201.1949 |
| 345 | Congo, Rep.      | Africa   | 1992 | 56.43300 | 2409073  | 4016.2395 |
| 346 | Congo, Rep.      | Africa   | 1997 | 52.96200 | 2800947  | 3484.1644 |
| 347 | Congo, Rep.      | Africa   | 2002 | 52.97000 | 3328795  | 3484.0620 |

|     |               |          |      |          |          |            |
|-----|---------------|----------|------|----------|----------|------------|
| 348 | Congo, Rep.   | Africa   | 2007 | 55.32200 | 3800610  | 3632.5578  |
| 349 | Costa Rica    | Americas | 1952 | 57.20600 | 926317   | 2627.0095  |
| 350 | Costa Rica    | Americas | 1957 | 60.02600 | 1112300  | 2990.0108  |
| 351 | Costa Rica    | Americas | 1962 | 62.84200 | 1345187  | 3460.9370  |
| 352 | Costa Rica    | Americas | 1967 | 65.42400 | 1588717  | 4161.7278  |
| 353 | Costa Rica    | Americas | 1972 | 67.84900 | 1834796  | 5118.1469  |
| 354 | Costa Rica    | Americas | 1977 | 70.75000 | 2108457  | 5926.8770  |
| 355 | Costa Rica    | Americas | 1982 | 73.45000 | 2424367  | 5262.7348  |
| 356 | Costa Rica    | Americas | 1987 | 74.75200 | 2799811  | 5629.9153  |
| 357 | Costa Rica    | Americas | 1992 | 75.71300 | 3173216  | 6160.4163  |
| 358 | Costa Rica    | Americas | 1997 | 77.26000 | 3518107  | 6677.0453  |
| 359 | Costa Rica    | Americas | 2002 | 78.12300 | 3834934  | 7723.4472  |
| 360 | Costa Rica    | Americas | 2007 | 78.78200 | 4133884  | 9645.0614  |
| 361 | Cote d'Ivoire | Africa   | 1952 | 40.47700 | 2977019  | 1388.5947  |
| 362 | Cote d'Ivoire | Africa   | 1957 | 42.46900 | 3300000  | 1500.8959  |
| 363 | Cote d'Ivoire | Africa   | 1962 | 44.93000 | 3832408  | 1728.8694  |
| 364 | Cote d'Ivoire | Africa   | 1967 | 47.35000 | 4744870  | 2052.0505  |
| 365 | Cote d'Ivoire | Africa   | 1972 | 49.80100 | 6071696  | 2378.2011  |
| 366 | Cote d'Ivoire | Africa   | 1977 | 52.37400 | 7459574  | 2517.7365  |
| 367 | Cote d'Ivoire | Africa   | 1982 | 53.98300 | 9025951  | 2602.7102  |
| 368 | Cote d'Ivoire | Africa   | 1987 | 54.65500 | 10761098 | 2156.9561  |
| 369 | Cote d'Ivoire | Africa   | 1992 | 52.04400 | 12772596 | 1648.0738  |
| 370 | Cote d'Ivoire | Africa   | 1997 | 47.99100 | 14625967 | 1786.2654  |
| 371 | Cote d'Ivoire | Africa   | 2002 | 46.83200 | 16252726 | 1648.8008  |
| 372 | Cote d'Ivoire | Africa   | 2007 | 48.32800 | 18013409 | 1544.7501  |
| 373 | Croatia       | Europe   | 1952 | 61.21000 | 3882229  | 3119.2365  |
| 374 | Croatia       | Europe   | 1957 | 64.77000 | 3991242  | 4338.2316  |
| 375 | Croatia       | Europe   | 1962 | 67.13000 | 4076557  | 5477.8900  |
| 376 | Croatia       | Europe   | 1967 | 68.50000 | 4174366  | 6960.2979  |
| 377 | Croatia       | Europe   | 1972 | 69.61000 | 4225310  | 9164.0901  |
| 378 | Croatia       | Europe   | 1977 | 70.64000 | 4318673  | 11305.3852 |
| 379 | Croatia       | Europe   | 1982 | 70.46000 | 4413368  | 13221.8218 |
| 380 | Croatia       | Europe   | 1987 | 71.52000 | 4484310  | 13822.5839 |
| 381 | Croatia       | Europe   | 1992 | 72.52700 | 4494013  | 8447.7949  |
| 382 | Croatia       | Europe   | 1997 | 73.68000 | 4444595  | 9875.6045  |
| 383 | Croatia       | Europe   | 2002 | 74.87600 | 4481020  | 11628.3890 |
| 384 | Croatia       | Europe   | 2007 | 75.74800 | 4493312  | 14619.2227 |
| 385 | Cuba          | Americas | 1952 | 59.42100 | 6007797  | 5586.5388  |
| 386 | Cuba          | Americas | 1957 | 62.32500 | 6640752  | 6092.1744  |
| 387 | Cuba          | Americas | 1962 | 65.24600 | 7254373  | 5180.7559  |
| 388 | Cuba          | Americas | 1967 | 68.29000 | 8139332  | 5690.2680  |
| 389 | Cuba          | Americas | 1972 | 70.72300 | 8831348  | 5305.4453  |
| 390 | Cuba          | Americas | 1977 | 72.64900 | 9537988  | 6380.4950  |

|     |                    |          |      |          |          |            |
|-----|--------------------|----------|------|----------|----------|------------|
| 391 | Cuba               | Americas | 1982 | 73.71700 | 9789224  | 7316.9181  |
| 392 | Cuba               | Americas | 1987 | 74.17400 | 10239839 | 7532.9248  |
| 393 | Cuba               | Americas | 1992 | 74.41400 | 10723260 | 5592.8440  |
| 394 | Cuba               | Americas | 1997 | 76.15100 | 10983007 | 5431.9904  |
| 395 | Cuba               | Americas | 2002 | 77.15800 | 11226999 | 6340.6467  |
| 396 | Cuba               | Americas | 2007 | 78.27300 | 11416987 | 8948.1029  |
| 397 | Czech Republic     | Europe   | 1952 | 66.87000 | 9125183  | 6876.1403  |
| 398 | Czech Republic     | Europe   | 1957 | 69.03000 | 9513758  | 8256.3439  |
| 399 | Czech Republic     | Europe   | 1962 | 69.90000 | 9620282  | 10136.8671 |
| 400 | Czech Republic     | Europe   | 1967 | 70.38000 | 9835109  | 11399.4449 |
| 401 | Czech Republic     | Europe   | 1972 | 70.29000 | 9862158  | 13108.4536 |
| 402 | Czech Republic     | Europe   | 1977 | 70.71000 | 10161915 | 14800.1606 |
| 403 | Czech Republic     | Europe   | 1982 | 70.96000 | 10303704 | 15377.2285 |
| 404 | Czech Republic     | Europe   | 1987 | 71.58000 | 10311597 | 16310.4434 |
| 405 | Czech Republic     | Europe   | 1992 | 72.40000 | 10315702 | 14297.0212 |
| 406 | Czech Republic     | Europe   | 1997 | 74.01000 | 10300707 | 16048.5142 |
| 407 | Czech Republic     | Europe   | 2002 | 75.51000 | 10256295 | 17596.2102 |
| 408 | Czech Republic     | Europe   | 2007 | 76.48600 | 10228744 | 22833.3085 |
| 409 | Denmark            | Europe   | 1952 | 70.78000 | 4334000  | 9692.3852  |
| 410 | Denmark            | Europe   | 1957 | 71.81000 | 4487831  | 11099.6593 |
| 411 | Denmark            | Europe   | 1962 | 72.35000 | 4646899  | 13583.3135 |
| 412 | Denmark            | Europe   | 1967 | 72.96000 | 4838800  | 15937.2112 |
| 413 | Denmark            | Europe   | 1972 | 73.47000 | 4991596  | 18866.2072 |
| 414 | Denmark            | Europe   | 1977 | 74.69000 | 5088419  | 20422.9015 |
| 415 | Denmark            | Europe   | 1982 | 74.63000 | 5117810  | 21688.0405 |
| 416 | Denmark            | Europe   | 1987 | 74.80000 | 5127024  | 25116.1758 |
| 417 | Denmark            | Europe   | 1992 | 75.33000 | 5171393  | 26406.7399 |
| 418 | Denmark            | Europe   | 1997 | 76.11000 | 5283663  | 29804.3457 |
| 419 | Denmark            | Europe   | 2002 | 77.18000 | 5374693  | 32166.5001 |
| 420 | Denmark            | Europe   | 2007 | 78.33200 | 5468120  | 35278.4187 |
| 421 | Djibouti           | Africa   | 1952 | 34.81200 | 63149    | 2669.5295  |
| 422 | Djibouti           | Africa   | 1957 | 37.32800 | 71851    | 2864.9691  |
| 423 | Djibouti           | Africa   | 1962 | 39.69300 | 89898    | 3020.9893  |
| 424 | Djibouti           | Africa   | 1967 | 42.07400 | 127617   | 3020.0505  |
| 425 | Djibouti           | Africa   | 1972 | 44.36600 | 178848   | 3694.2124  |
| 426 | Djibouti           | Africa   | 1977 | 46.51900 | 228694   | 3081.7610  |
| 427 | Djibouti           | Africa   | 1982 | 48.81200 | 305991   | 2879.4681  |
| 428 | Djibouti           | Africa   | 1987 | 50.04000 | 311025   | 2880.1026  |
| 429 | Djibouti           | Africa   | 1992 | 51.60400 | 384156   | 2377.1562  |
| 430 | Djibouti           | Africa   | 1997 | 53.15700 | 417908   | 1895.0170  |
| 431 | Djibouti           | Africa   | 2002 | 53.37300 | 447416   | 1908.2609  |
| 432 | Djibouti           | Africa   | 2007 | 54.79100 | 496374   | 2082.4816  |
| 433 | Dominican Republic | Americas | 1952 | 45.92800 | 2491346  | 1397.7171  |

|     |                    |          |      |          |          |           |
|-----|--------------------|----------|------|----------|----------|-----------|
| 434 | Dominican Republic | Americas | 1957 | 49.82800 | 2923186  | 1544.4030 |
| 435 | Dominican Republic | Americas | 1962 | 53.45900 | 3453434  | 1662.1374 |
| 436 | Dominican Republic | Americas | 1967 | 56.75100 | 4049146  | 1653.7230 |
| 437 | Dominican Republic | Americas | 1972 | 59.63100 | 4671329  | 2189.8745 |
| 438 | Dominican Republic | Americas | 1977 | 61.78800 | 5302800  | 2681.9889 |
| 439 | Dominican Republic | Americas | 1982 | 63.72700 | 5968349  | 2861.0924 |
| 440 | Dominican Republic | Americas | 1987 | 66.04600 | 6655297  | 2899.8422 |
| 441 | Dominican Republic | Americas | 1992 | 68.45700 | 7351181  | 3044.2142 |
| 442 | Dominican Republic | Americas | 1997 | 69.95700 | 7992357  | 3614.1013 |
| 443 | Dominican Republic | Americas | 2002 | 70.84700 | 8650322  | 4563.8082 |
| 444 | Dominican Republic | Americas | 2007 | 72.23500 | 9319622  | 6025.3748 |
| 445 | Ecuador            | Americas | 1952 | 48.35700 | 3548753  | 3522.1107 |
| 446 | Ecuador            | Americas | 1957 | 51.35600 | 4058385  | 3780.5467 |
| 447 | Ecuador            | Americas | 1962 | 54.64000 | 4681707  | 4086.1141 |
| 448 | Ecuador            | Americas | 1967 | 56.67800 | 5432424  | 4579.0742 |
| 449 | Ecuador            | Americas | 1972 | 58.79600 | 6298651  | 5280.9947 |
| 450 | Ecuador            | Americas | 1977 | 61.31000 | 7278866  | 6679.6233 |
| 451 | Ecuador            | Americas | 1982 | 64.34200 | 8365850  | 7213.7913 |
| 452 | Ecuador            | Americas | 1987 | 67.23100 | 9545158  | 6481.7770 |
| 453 | Ecuador            | Americas | 1992 | 69.61300 | 10748394 | 7103.7026 |
| 454 | Ecuador            | Americas | 1997 | 72.31200 | 11911819 | 7429.4559 |
| 455 | Ecuador            | Americas | 2002 | 74.17300 | 12921234 | 5773.0445 |
| 456 | Ecuador            | Americas | 2007 | 74.99400 | 13755680 | 6873.2623 |
| 457 | Egypt              | Africa   | 1952 | 41.89300 | 22223309 | 1418.8224 |
| 458 | Egypt              | Africa   | 1957 | 44.44400 | 25009741 | 1458.9153 |
| 459 | Egypt              | Africa   | 1962 | 46.99200 | 28173309 | 1693.3359 |
| 460 | Egypt              | Africa   | 1967 | 49.29300 | 31681188 | 1814.8807 |
| 461 | Egypt              | Africa   | 1972 | 51.13700 | 34807417 | 2024.0081 |
| 462 | Egypt              | Africa   | 1977 | 53.31900 | 38783863 | 2785.4936 |
| 463 | Egypt              | Africa   | 1982 | 56.00600 | 45681811 | 3503.7296 |
| 464 | Egypt              | Africa   | 1987 | 59.79700 | 52799062 | 3885.4607 |
| 465 | Egypt              | Africa   | 1992 | 63.67400 | 59402198 | 3794.7552 |
| 466 | Egypt              | Africa   | 1997 | 67.21700 | 66134291 | 4173.1818 |
| 467 | Egypt              | Africa   | 2002 | 69.80600 | 73312559 | 4754.6044 |
| 468 | Egypt              | Africa   | 2007 | 71.33800 | 80264543 | 5581.1810 |
| 469 | El Salvador        | Americas | 1952 | 45.26200 | 2042865  | 3048.3029 |
| 470 | El Salvador        | Americas | 1957 | 48.57000 | 2355805  | 3421.5232 |
| 471 | El Salvador        | Americas | 1962 | 52.30700 | 2747687  | 3776.8036 |
| 472 | El Salvador        | Americas | 1967 | 55.85500 | 3232927  | 4358.5954 |
| 473 | El Salvador        | Americas | 1972 | 58.20700 | 3790903  | 4520.2460 |
| 474 | El Salvador        | Americas | 1977 | 56.69600 | 4282586  | 5138.9224 |
| 475 | El Salvador        | Americas | 1982 | 56.60400 | 4474873  | 4098.3442 |
| 476 | El Salvador        | Americas | 1987 | 63.15400 | 4842194  | 4140.4421 |

|     |                   |          |      |          |          |            |
|-----|-------------------|----------|------|----------|----------|------------|
| 477 | El Salvador       | Americas | 1992 | 66.79800 | 5274649  | 4444.2317  |
| 478 | El Salvador       | Americas | 1997 | 69.53500 | 5783439  | 5154.8255  |
| 479 | El Salvador       | Americas | 2002 | 70.73400 | 6353681  | 5351.5687  |
| 480 | El Salvador       | Americas | 2007 | 71.87800 | 6939688  | 5728.3535  |
| 481 | Equatorial Guinea | Africa   | 1952 | 34.48200 | 216964   | 375.6431   |
| 482 | Equatorial Guinea | Africa   | 1957 | 35.98300 | 232922   | 426.0964   |
| 483 | Equatorial Guinea | Africa   | 1962 | 37.48500 | 249220   | 582.8420   |
| 484 | Equatorial Guinea | Africa   | 1967 | 38.98700 | 259864   | 915.5960   |
| 485 | Equatorial Guinea | Africa   | 1972 | 40.51600 | 277603   | 672.4123   |
| 486 | Equatorial Guinea | Africa   | 1977 | 42.02400 | 192675   | 958.5668   |
| 487 | Equatorial Guinea | Africa   | 1982 | 43.66200 | 285483   | 927.8253   |
| 488 | Equatorial Guinea | Africa   | 1987 | 45.66400 | 341244   | 966.8968   |
| 489 | Equatorial Guinea | Africa   | 1992 | 47.54500 | 387838   | 1132.0550  |
| 490 | Equatorial Guinea | Africa   | 1997 | 48.24500 | 439971   | 2814.4808  |
| 491 | Equatorial Guinea | Africa   | 2002 | 49.34800 | 495627   | 7703.4959  |
| 492 | Equatorial Guinea | Africa   | 2007 | 51.57900 | 551201   | 12154.0897 |
| 493 | Eritrea           | Africa   | 1952 | 35.92800 | 1438760  | 328.9406   |
| 494 | Eritrea           | Africa   | 1957 | 38.04700 | 1542611  | 344.1619   |
| 495 | Eritrea           | Africa   | 1962 | 40.15800 | 1666618  | 380.9958   |
| 496 | Eritrea           | Africa   | 1967 | 42.18900 | 1820319  | 468.7950   |
| 497 | Eritrea           | Africa   | 1972 | 44.14200 | 2260187  | 514.3242   |
| 498 | Eritrea           | Africa   | 1977 | 44.53500 | 2512642  | 505.7538   |
| 499 | Eritrea           | Africa   | 1982 | 43.89000 | 2637297  | 524.8758   |
| 500 | Eritrea           | Africa   | 1987 | 46.45300 | 2915959  | 521.1341   |
| 501 | Eritrea           | Africa   | 1992 | 49.99100 | 3668440  | 582.8585   |
| 502 | Eritrea           | Africa   | 1997 | 53.37800 | 4058319  | 913.4708   |
| 503 | Eritrea           | Africa   | 2002 | 55.24000 | 4414865  | 765.3500   |
| 504 | Eritrea           | Africa   | 2007 | 58.04000 | 4906585  | 641.3695   |
| 505 | Ethiopia          | Africa   | 1952 | 34.07800 | 20860941 | 362.1463   |
| 506 | Ethiopia          | Africa   | 1957 | 36.66700 | 22815614 | 378.9042   |
| 507 | Ethiopia          | Africa   | 1962 | 40.05900 | 25145372 | 419.4564   |
| 508 | Ethiopia          | Africa   | 1967 | 42.11500 | 27860297 | 516.1186   |
| 509 | Ethiopia          | Africa   | 1972 | 43.51500 | 30770372 | 566.2439   |
| 510 | Ethiopia          | Africa   | 1977 | 44.51000 | 34617799 | 556.8084   |
| 511 | Ethiopia          | Africa   | 1982 | 44.91600 | 38111756 | 577.8607   |
| 512 | Ethiopia          | Africa   | 1987 | 46.68400 | 42999530 | 573.7413   |
| 513 | Ethiopia          | Africa   | 1992 | 48.09100 | 52088559 | 421.3535   |
| 514 | Ethiopia          | Africa   | 1997 | 49.40200 | 59861301 | 515.8894   |
| 515 | Ethiopia          | Africa   | 2002 | 50.72500 | 67946797 | 530.0535   |
| 516 | Ethiopia          | Africa   | 2007 | 52.94700 | 76511887 | 690.8056   |
| 517 | Finland           | Europe   | 1952 | 66.55000 | 4090500  | 6424.5191  |
| 518 | Finland           | Europe   | 1957 | 67.49000 | 4324000  | 7545.4154  |
| 519 | Finland           | Europe   | 1962 | 68.75000 | 4491443  | 9371.8426  |

|     |         |        |      |          |          |            |
|-----|---------|--------|------|----------|----------|------------|
| 520 | Finland | Europe | 1967 | 69.83000 | 4605744  | 10921.6363 |
| 521 | Finland | Europe | 1972 | 70.87000 | 4639657  | 14358.8759 |
| 522 | Finland | Europe | 1977 | 72.52000 | 4738902  | 15605.4228 |
| 523 | Finland | Europe | 1982 | 74.55000 | 4826933  | 18533.1576 |
| 524 | Finland | Europe | 1987 | 74.83000 | 4931729  | 21141.0122 |
| 525 | Finland | Europe | 1992 | 75.70000 | 5041039  | 20647.1650 |
| 526 | Finland | Europe | 1997 | 77.13000 | 5134406  | 23723.9502 |
| 527 | Finland | Europe | 2002 | 78.37000 | 5193039  | 28204.5906 |
| 528 | Finland | Europe | 2007 | 79.31300 | 5238460  | 33207.0844 |
| 529 | France  | Europe | 1952 | 67.41000 | 42459667 | 7029.8093  |
| 530 | France  | Europe | 1957 | 68.93000 | 44310863 | 8662.8349  |
| 531 | France  | Europe | 1962 | 70.51000 | 47124000 | 10560.4855 |
| 532 | France  | Europe | 1967 | 71.55000 | 49569000 | 12999.9177 |
| 533 | France  | Europe | 1972 | 72.38000 | 51732000 | 16107.1917 |
| 534 | France  | Europe | 1977 | 73.83000 | 53165019 | 18292.6351 |
| 535 | France  | Europe | 1982 | 74.89000 | 54433565 | 20293.8975 |
| 536 | France  | Europe | 1987 | 76.34000 | 55630100 | 22066.4421 |
| 537 | France  | Europe | 1992 | 77.46000 | 57374179 | 24703.7961 |
| 538 | France  | Europe | 1997 | 78.64000 | 58623428 | 25889.7849 |
| 539 | France  | Europe | 2002 | 79.59000 | 59925035 | 28926.0323 |
| 540 | France  | Europe | 2007 | 80.65700 | 61083916 | 30470.0167 |
| 541 | Gabon   | Africa | 1952 | 37.00300 | 420702   | 4293.4765  |
| 542 | Gabon   | Africa | 1957 | 38.99900 | 434904   | 4976.1981  |
| 543 | Gabon   | Africa | 1962 | 40.48900 | 455661   | 6631.4592  |
| 544 | Gabon   | Africa | 1967 | 44.59800 | 489004   | 8358.7620  |
| 545 | Gabon   | Africa | 1972 | 48.69000 | 537977   | 11401.9484 |
| 546 | Gabon   | Africa | 1977 | 52.79000 | 706367   | 21745.5733 |
| 547 | Gabon   | Africa | 1982 | 56.56400 | 753874   | 15113.3619 |
| 548 | Gabon   | Africa | 1987 | 60.19000 | 880397   | 11864.4084 |
| 549 | Gabon   | Africa | 1992 | 61.36600 | 985739   | 13522.1575 |
| 550 | Gabon   | Africa | 1997 | 60.46100 | 1126189  | 14722.8419 |
| 551 | Gabon   | Africa | 2002 | 56.76100 | 1299304  | 12521.7139 |
| 552 | Gabon   | Africa | 2007 | 56.73500 | 1454867  | 13206.4845 |
| 553 | Gambia  | Africa | 1952 | 30.00000 | 284320   | 485.2307   |
| 554 | Gambia  | Africa | 1957 | 32.06500 | 323150   | 520.9267   |
| 555 | Gambia  | Africa | 1962 | 33.89600 | 374020   | 599.6503   |
| 556 | Gambia  | Africa | 1967 | 35.85700 | 439593   | 734.7829   |
| 557 | Gambia  | Africa | 1972 | 38.30800 | 517101   | 756.0868   |
| 558 | Gambia  | Africa | 1977 | 41.84200 | 608274   | 884.7553   |
| 559 | Gambia  | Africa | 1982 | 45.58000 | 715523   | 835.8096   |
| 560 | Gambia  | Africa | 1987 | 49.26500 | 848406   | 611.6589   |
| 561 | Gambia  | Africa | 1992 | 52.64400 | 1025384  | 665.6244   |
| 562 | Gambia  | Africa | 1997 | 55.86100 | 1235767  | 653.7302   |

|     |           |          |      |          |          |            |
|-----|-----------|----------|------|----------|----------|------------|
| 563 | Gambia    | Africa   | 2002 | 58.04100 | 1457766  | 660.5856   |
| 564 | Gambia    | Africa   | 2007 | 59.44800 | 1688359  | 752.7497   |
| 565 | Germany   | Europe   | 1952 | 67.50000 | 69145952 | 7144.1144  |
| 566 | Germany   | Europe   | 1957 | 69.10000 | 71019069 | 10187.8267 |
| 567 | Germany   | Europe   | 1962 | 70.30000 | 73739117 | 12902.4629 |
| 568 | Germany   | Europe   | 1967 | 70.80000 | 76368453 | 14745.6256 |
| 569 | Germany   | Europe   | 1972 | 71.00000 | 78717088 | 18016.1803 |
| 570 | Germany   | Europe   | 1977 | 72.50000 | 78160773 | 20512.9212 |
| 571 | Germany   | Europe   | 1982 | 73.80000 | 78335266 | 22031.5327 |
| 572 | Germany   | Europe   | 1987 | 74.84700 | 77718298 | 24639.1857 |
| 573 | Germany   | Europe   | 1992 | 76.07000 | 80597764 | 26505.3032 |
| 574 | Germany   | Europe   | 1997 | 77.34000 | 82011073 | 27788.8842 |
| 575 | Germany   | Europe   | 2002 | 78.67000 | 82350671 | 30035.8020 |
| 576 | Germany   | Europe   | 2007 | 79.40600 | 82400996 | 32170.3744 |
| 577 | Ghana     | Africa   | 1952 | 43.14900 | 5581001  | 911.2989   |
| 578 | Ghana     | Africa   | 1957 | 44.77900 | 6391288  | 1043.5615  |
| 579 | Ghana     | Africa   | 1962 | 46.45200 | 7355248  | 1190.0411  |
| 580 | Ghana     | Africa   | 1967 | 48.07200 | 8490213  | 1125.6972  |
| 581 | Ghana     | Africa   | 1972 | 49.87500 | 9354120  | 1178.2237  |
| 582 | Ghana     | Africa   | 1977 | 51.75600 | 10538093 | 993.2240   |
| 583 | Ghana     | Africa   | 1982 | 53.74400 | 11400338 | 876.0326   |
| 584 | Ghana     | Africa   | 1987 | 55.72900 | 14168101 | 847.0061   |
| 585 | Ghana     | Africa   | 1992 | 57.50100 | 16278738 | 925.0602   |
| 586 | Ghana     | Africa   | 1997 | 58.55600 | 18418288 | 1005.2458  |
| 587 | Ghana     | Africa   | 2002 | 58.45300 | 20550751 | 1111.9846  |
| 588 | Ghana     | Africa   | 2007 | 60.02200 | 22873338 | 1327.6089  |
| 589 | Greece    | Europe   | 1952 | 65.86000 | 7733250  | 3530.6901  |
| 590 | Greece    | Europe   | 1957 | 67.86000 | 8096218  | 4916.2999  |
| 591 | Greece    | Europe   | 1962 | 69.51000 | 8448233  | 6017.1907  |
| 592 | Greece    | Europe   | 1967 | 71.00000 | 8716441  | 8513.0970  |
| 593 | Greece    | Europe   | 1972 | 72.34000 | 8888628  | 12724.8296 |
| 594 | Greece    | Europe   | 1977 | 73.68000 | 9308479  | 14195.5243 |
| 595 | Greece    | Europe   | 1982 | 75.24000 | 9786480  | 15268.4209 |
| 596 | Greece    | Europe   | 1987 | 76.67000 | 9974490  | 16120.5284 |
| 597 | Greece    | Europe   | 1992 | 77.03000 | 10325429 | 17541.4963 |
| 598 | Greece    | Europe   | 1997 | 77.86900 | 10502372 | 18747.6981 |
| 599 | Greece    | Europe   | 2002 | 78.25600 | 10603863 | 22514.2548 |
| 600 | Greece    | Europe   | 2007 | 79.48300 | 10706290 | 27538.4119 |
| 601 | Guatemala | Americas | 1952 | 42.02300 | 3146381  | 2428.2378  |
| 602 | Guatemala | Americas | 1957 | 44.14200 | 3640876  | 2617.1560  |
| 603 | Guatemala | Americas | 1962 | 46.95400 | 4208858  | 2750.3644  |
| 604 | Guatemala | Americas | 1967 | 50.01600 | 4690773  | 3242.5311  |
| 605 | Guatemala | Americas | 1972 | 53.73800 | 5149581  | 4031.4083  |

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|-----|---------------|----------|------|----------|----------|-----------|
| 606 | Guatemala     | Americas | 1977 | 56.02900 | 5703430  | 4879.9927 |
| 607 | Guatemala     | Americas | 1982 | 58.13700 | 6395630  | 4820.4948 |
| 608 | Guatemala     | Americas | 1987 | 60.78200 | 7326406  | 4246.4860 |
| 609 | Guatemala     | Americas | 1992 | 63.37300 | 8486949  | 4439.4508 |
| 610 | Guatemala     | Americas | 1997 | 66.32200 | 9803875  | 4684.3138 |
| 611 | Guatemala     | Americas | 2002 | 68.97800 | 11178650 | 4858.3475 |
| 612 | Guatemala     | Americas | 2007 | 70.25900 | 12572928 | 5186.0500 |
| 613 | Guinea        | Africa   | 1952 | 33.60900 | 2664249  | 510.1965  |
| 614 | Guinea        | Africa   | 1957 | 34.55800 | 2876726  | 576.2670  |
| 615 | Guinea        | Africa   | 1962 | 35.75300 | 3140003  | 686.3737  |
| 616 | Guinea        | Africa   | 1967 | 37.19700 | 3451418  | 708.7595  |
| 617 | Guinea        | Africa   | 1972 | 38.84200 | 3811387  | 741.6662  |
| 618 | Guinea        | Africa   | 1977 | 40.76200 | 4227026  | 874.6859  |
| 619 | Guinea        | Africa   | 1982 | 42.89100 | 4710497  | 857.2504  |
| 620 | Guinea        | Africa   | 1987 | 45.55200 | 5650262  | 805.5725  |
| 621 | Guinea        | Africa   | 1992 | 48.57600 | 6990574  | 794.3484  |
| 622 | Guinea        | Africa   | 1997 | 51.45500 | 8048834  | 869.4498  |
| 623 | Guinea        | Africa   | 2002 | 53.67600 | 8807818  | 945.5836  |
| 624 | Guinea        | Africa   | 2007 | 56.00700 | 9947814  | 942.6542  |
| 625 | Guinea-Bissau | Africa   | 1952 | 32.50000 | 580653   | 299.8503  |
| 626 | Guinea-Bissau | Africa   | 1957 | 33.48900 | 601095   | 431.7905  |
| 627 | Guinea-Bissau | Africa   | 1962 | 34.48800 | 627820   | 522.0344  |
| 628 | Guinea-Bissau | Africa   | 1967 | 35.49200 | 601287   | 715.5806  |
| 629 | Guinea-Bissau | Africa   | 1972 | 36.48600 | 625361   | 820.2246  |
| 630 | Guinea-Bissau | Africa   | 1977 | 37.46500 | 745228   | 764.7260  |
| 631 | Guinea-Bissau | Africa   | 1982 | 39.32700 | 825987   | 838.1240  |
| 632 | Guinea-Bissau | Africa   | 1987 | 41.24500 | 927524   | 736.4154  |
| 633 | Guinea-Bissau | Africa   | 1992 | 43.26600 | 1050938  | 745.5399  |
| 634 | Guinea-Bissau | Africa   | 1997 | 44.87300 | 1193708  | 796.6645  |
| 635 | Guinea-Bissau | Africa   | 2002 | 45.50400 | 1332459  | 575.7047  |
| 636 | Guinea-Bissau | Africa   | 2007 | 46.38800 | 1472041  | 579.2317  |
| 637 | Haiti         | Americas | 1952 | 37.57900 | 3201488  | 1840.3669 |
| 638 | Haiti         | Americas | 1957 | 40.69600 | 3507701  | 1726.8879 |
| 639 | Haiti         | Americas | 1962 | 43.59000 | 3880130  | 1796.5890 |
| 640 | Haiti         | Americas | 1967 | 46.24300 | 4318137  | 1452.0577 |
| 641 | Haiti         | Americas | 1972 | 48.04200 | 4698301  | 1654.4569 |
| 642 | Haiti         | Americas | 1977 | 49.92300 | 4908554  | 1874.2989 |
| 643 | Haiti         | Americas | 1982 | 51.46100 | 5198399  | 2011.1595 |
| 644 | Haiti         | Americas | 1987 | 53.63600 | 5756203  | 1823.0160 |
| 645 | Haiti         | Americas | 1992 | 55.08900 | 6326682  | 1456.3095 |
| 646 | Haiti         | Americas | 1997 | 56.67100 | 6913545  | 1341.7269 |
| 647 | Haiti         | Americas | 2002 | 58.13700 | 7607651  | 1270.3649 |
| 648 | Haiti         | Americas | 2007 | 60.91600 | 8502814  | 1201.6372 |

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|-----|------------------|----------|------|----------|----------|------------|
| 649 | Honduras         | Americas | 1952 | 41.91200 | 1517453  | 2194.9262  |
| 650 | Honduras         | Americas | 1957 | 44.66500 | 1770390  | 2220.4877  |
| 651 | Honduras         | Americas | 1962 | 48.04100 | 2090162  | 2291.1568  |
| 652 | Honduras         | Americas | 1967 | 50.92400 | 2500689  | 2538.2694  |
| 653 | Honduras         | Americas | 1972 | 53.88400 | 2965146  | 2529.8423  |
| 654 | Honduras         | Americas | 1977 | 57.40200 | 3055235  | 3203.2081  |
| 655 | Honduras         | Americas | 1982 | 60.90900 | 3669448  | 3121.7608  |
| 656 | Honduras         | Americas | 1987 | 64.49200 | 4372203  | 3023.0967  |
| 657 | Honduras         | Americas | 1992 | 66.39900 | 5077347  | 3081.6946  |
| 658 | Honduras         | Americas | 1997 | 67.65900 | 5867957  | 3160.4549  |
| 659 | Honduras         | Americas | 2002 | 68.56500 | 6677328  | 3099.7287  |
| 660 | Honduras         | Americas | 2007 | 70.19800 | 7483763  | 3548.3308  |
| 661 | Hong Kong, China | Asia     | 1952 | 60.96000 | 2125900  | 3054.4212  |
| 662 | Hong Kong, China | Asia     | 1957 | 64.75000 | 2736300  | 3629.0765  |
| 663 | Hong Kong, China | Asia     | 1962 | 67.65000 | 3305200  | 4692.6483  |
| 664 | Hong Kong, China | Asia     | 1967 | 70.00000 | 3722800  | 6197.9628  |
| 665 | Hong Kong, China | Asia     | 1972 | 72.00000 | 4115700  | 8315.9281  |
| 666 | Hong Kong, China | Asia     | 1977 | 73.60000 | 4583700  | 11186.1413 |
| 667 | Hong Kong, China | Asia     | 1982 | 75.45000 | 5264500  | 14560.5305 |
| 668 | Hong Kong, China | Asia     | 1987 | 76.20000 | 5584510  | 20038.4727 |
| 669 | Hong Kong, China | Asia     | 1992 | 77.60100 | 5829696  | 24757.6030 |
| 670 | Hong Kong, China | Asia     | 1997 | 80.00000 | 6495918  | 28377.6322 |
| 671 | Hong Kong, China | Asia     | 2002 | 81.49500 | 6762476  | 30209.0152 |
| 672 | Hong Kong, China | Asia     | 2007 | 82.20800 | 6980412  | 39724.9787 |
| 673 | Hungary          | Europe   | 1952 | 64.03000 | 9504000  | 5263.6738  |
| 674 | Hungary          | Europe   | 1957 | 66.41000 | 9839000  | 6040.1800  |
| 675 | Hungary          | Europe   | 1962 | 67.96000 | 10063000 | 7550.3599  |
| 676 | Hungary          | Europe   | 1967 | 69.50000 | 10223422 | 9326.6447  |
| 677 | Hungary          | Europe   | 1972 | 69.76000 | 10394091 | 10168.6561 |
| 678 | Hungary          | Europe   | 1977 | 69.95000 | 10637171 | 11674.8374 |
| 679 | Hungary          | Europe   | 1982 | 69.39000 | 10705535 | 12545.9907 |
| 680 | Hungary          | Europe   | 1987 | 69.58000 | 10612740 | 12986.4800 |
| 681 | Hungary          | Europe   | 1992 | 69.17000 | 10348684 | 10535.6285 |
| 682 | Hungary          | Europe   | 1997 | 71.04000 | 10244684 | 11712.7768 |
| 683 | Hungary          | Europe   | 2002 | 72.59000 | 10083313 | 14843.9356 |
| 684 | Hungary          | Europe   | 2007 | 73.33800 | 9956108  | 18008.9444 |
| 685 | Iceland          | Europe   | 1952 | 72.49000 | 147962   | 7267.6884  |
| 686 | Iceland          | Europe   | 1957 | 73.47000 | 165110   | 9244.0014  |
| 687 | Iceland          | Europe   | 1962 | 73.68000 | 182053   | 10350.1591 |
| 688 | Iceland          | Europe   | 1967 | 73.73000 | 198676   | 13319.8957 |
| 689 | Iceland          | Europe   | 1972 | 74.46000 | 209275   | 15798.0636 |
| 690 | Iceland          | Europe   | 1977 | 76.11000 | 221823   | 19654.9625 |
| 691 | Iceland          | Europe   | 1982 | 76.99000 | 233997   | 23269.6075 |

|     |           |        |      |          |            |            |
|-----|-----------|--------|------|----------|------------|------------|
| 692 | Iceland   | Europe | 1987 | 77.23000 | 244676     | 26923.2063 |
| 693 | Iceland   | Europe | 1992 | 78.77000 | 259012     | 25144.3920 |
| 694 | Iceland   | Europe | 1997 | 78.95000 | 271192     | 28061.0997 |
| 695 | Iceland   | Europe | 2002 | 80.50000 | 288030     | 31163.2020 |
| 696 | Iceland   | Europe | 2007 | 81.75700 | 301931     | 36180.7892 |
| 697 | India     | Asia   | 1952 | 37.37300 | 372000000  | 546.5657   |
| 698 | India     | Asia   | 1957 | 40.24900 | 409000000  | 590.0620   |
| 699 | India     | Asia   | 1962 | 43.60500 | 454000000  | 658.3472   |
| 700 | India     | Asia   | 1967 | 47.19300 | 506000000  | 700.7706   |
| 701 | India     | Asia   | 1972 | 50.65100 | 567000000  | 724.0325   |
| 702 | India     | Asia   | 1977 | 54.20800 | 634000000  | 813.3373   |
| 703 | India     | Asia   | 1982 | 56.59600 | 708000000  | 855.7235   |
| 704 | India     | Asia   | 1987 | 58.55300 | 788000000  | 976.5127   |
| 705 | India     | Asia   | 1992 | 60.22300 | 872000000  | 1164.4068  |
| 706 | India     | Asia   | 1997 | 61.76500 | 959000000  | 1458.8174  |
| 707 | India     | Asia   | 2002 | 62.87900 | 1034172547 | 1746.7695  |
| 708 | India     | Asia   | 2007 | 64.69800 | 1110396331 | 2452.2104  |
| 709 | Indonesia | Asia   | 1952 | 37.46800 | 82052000   | 749.6817   |
| 710 | Indonesia | Asia   | 1957 | 39.91800 | 90124000   | 858.9003   |
| 711 | Indonesia | Asia   | 1962 | 42.51800 | 99028000   | 849.2898   |
| 712 | Indonesia | Asia   | 1967 | 45.96400 | 109343000  | 762.4318   |
| 713 | Indonesia | Asia   | 1972 | 49.20300 | 121282000  | 1111.1079  |
| 714 | Indonesia | Asia   | 1977 | 52.70200 | 136725000  | 1382.7021  |
| 715 | Indonesia | Asia   | 1982 | 56.15900 | 153343000  | 1516.8730  |
| 716 | Indonesia | Asia   | 1987 | 60.13700 | 169276000  | 1748.3570  |
| 717 | Indonesia | Asia   | 1992 | 62.68100 | 184816000  | 2383.1409  |
| 718 | Indonesia | Asia   | 1997 | 66.04100 | 199278000  | 3119.3356  |
| 719 | Indonesia | Asia   | 2002 | 68.58800 | 211060000  | 2873.9129  |
| 720 | Indonesia | Asia   | 2007 | 70.65000 | 223547000  | 3540.6516  |
| 721 | Iran      | Asia   | 1952 | 44.86900 | 17272000   | 3035.3260  |
| 722 | Iran      | Asia   | 1957 | 47.18100 | 19792000   | 3290.2576  |
| 723 | Iran      | Asia   | 1962 | 49.32500 | 22874000   | 4187.3298  |
| 724 | Iran      | Asia   | 1967 | 52.46900 | 26538000   | 5906.7318  |
| 725 | Iran      | Asia   | 1972 | 55.23400 | 30614000   | 9613.8186  |
| 726 | Iran      | Asia   | 1977 | 57.70200 | 35480679   | 11888.5951 |
| 727 | Iran      | Asia   | 1982 | 59.62000 | 43072751   | 7608.3346  |
| 728 | Iran      | Asia   | 1987 | 63.04000 | 51889696   | 6642.8814  |
| 729 | Iran      | Asia   | 1992 | 65.74200 | 60397973   | 7235.6532  |
| 730 | Iran      | Asia   | 1997 | 68.04200 | 63327987   | 8263.5903  |
| 731 | Iran      | Asia   | 2002 | 69.45100 | 66907826   | 9240.7620  |
| 732 | Iran      | Asia   | 2007 | 70.96400 | 69453570   | 11605.7145 |
| 733 | Iraq      | Asia   | 1952 | 45.32000 | 5441766    | 4129.7661  |
| 734 | Iraq      | Asia   | 1957 | 48.43700 | 6248643    | 6229.3336  |

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|-----|---------|--------|------|----------|----------|------------|
| 735 | Iraq    | Asia   | 1962 | 51.45700 | 7240260  | 8341.7378  |
| 736 | Iraq    | Asia   | 1967 | 54.45900 | 8519282  | 8931.4598  |
| 737 | Iraq    | Asia   | 1972 | 56.95000 | 10061506 | 9576.0376  |
| 738 | Iraq    | Asia   | 1977 | 60.41300 | 11882916 | 14688.2351 |
| 739 | Iraq    | Asia   | 1982 | 62.03800 | 14173318 | 14517.9071 |
| 740 | Iraq    | Asia   | 1987 | 65.04400 | 16543189 | 11643.5727 |
| 741 | Iraq    | Asia   | 1992 | 59.46100 | 17861905 | 3745.6407  |
| 742 | Iraq    | Asia   | 1997 | 58.81100 | 20775703 | 3076.2398  |
| 743 | Iraq    | Asia   | 2002 | 57.04600 | 24001816 | 4390.7173  |
| 744 | Iraq    | Asia   | 2007 | 59.54500 | 27499638 | 4471.0619  |
| 745 | Ireland | Europe | 1952 | 66.91000 | 2952156  | 5210.2803  |
| 746 | Ireland | Europe | 1957 | 68.90000 | 2878220  | 5599.0779  |
| 747 | Ireland | Europe | 1962 | 70.29000 | 2830000  | 6631.5973  |
| 748 | Ireland | Europe | 1967 | 71.08000 | 2900100  | 7655.5690  |
| 749 | Ireland | Europe | 1972 | 71.28000 | 3024400  | 9530.7729  |
| 750 | Ireland | Europe | 1977 | 72.03000 | 3271900  | 11150.9811 |
| 751 | Ireland | Europe | 1982 | 73.10000 | 3480000  | 12618.3214 |
| 752 | Ireland | Europe | 1987 | 74.36000 | 3539900  | 13872.8665 |
| 753 | Ireland | Europe | 1992 | 75.46700 | 3557761  | 17558.8155 |
| 754 | Ireland | Europe | 1997 | 76.12200 | 3667233  | 24521.9471 |
| 755 | Ireland | Europe | 2002 | 77.78300 | 3879155  | 34077.0494 |
| 756 | Ireland | Europe | 2007 | 78.88500 | 4109086  | 40675.9964 |
| 757 | Israel  | Asia   | 1952 | 65.39000 | 1620914  | 4086.5221  |
| 758 | Israel  | Asia   | 1957 | 67.84000 | 1944401  | 5385.2785  |
| 759 | Israel  | Asia   | 1962 | 69.39000 | 2310904  | 7105.6307  |
| 760 | Israel  | Asia   | 1967 | 70.75000 | 2693585  | 8393.7414  |
| 761 | Israel  | Asia   | 1972 | 71.63000 | 3095893  | 12786.9322 |
| 762 | Israel  | Asia   | 1977 | 73.06000 | 3495918  | 13306.6192 |
| 763 | Israel  | Asia   | 1982 | 74.45000 | 3858421  | 15367.0292 |
| 764 | Israel  | Asia   | 1987 | 75.60000 | 4203148  | 17122.4799 |
| 765 | Israel  | Asia   | 1992 | 76.93000 | 4936550  | 18051.5225 |
| 766 | Israel  | Asia   | 1997 | 78.26900 | 5531387  | 20896.6092 |
| 767 | Israel  | Asia   | 2002 | 79.69600 | 6029529  | 21905.5951 |
| 768 | Israel  | Asia   | 2007 | 80.74500 | 6426679  | 25523.2771 |
| 769 | Italy   | Europe | 1952 | 65.94000 | 47666000 | 4931.4042  |
| 770 | Italy   | Europe | 1957 | 67.81000 | 49182000 | 6248.6562  |
| 771 | Italy   | Europe | 1962 | 69.24000 | 50843200 | 8243.5823  |
| 772 | Italy   | Europe | 1967 | 71.06000 | 52667100 | 10022.4013 |
| 773 | Italy   | Europe | 1972 | 72.19000 | 54365564 | 12269.2738 |
| 774 | Italy   | Europe | 1977 | 73.48000 | 56059245 | 14255.9847 |
| 775 | Italy   | Europe | 1982 | 74.98000 | 56535636 | 16537.4835 |
| 776 | Italy   | Europe | 1987 | 76.42000 | 56729703 | 19207.2348 |
| 777 | Italy   | Europe | 1992 | 77.44000 | 56840847 | 22013.6449 |

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|-----|---------|----------|------|----------|-----------|------------|
| 778 | Italy   | Europe   | 1997 | 78.82000 | 57479469  | 24675.0245 |
| 779 | Italy   | Europe   | 2002 | 80.24000 | 57926999  | 27968.0982 |
| 780 | Italy   | Europe   | 2007 | 80.54600 | 58147733  | 28569.7197 |
| 781 | Jamaica | Americas | 1952 | 58.53000 | 1426095   | 2898.5309  |
| 782 | Jamaica | Americas | 1957 | 62.61000 | 1535090   | 4756.5258  |
| 783 | Jamaica | Americas | 1962 | 65.61000 | 1665128   | 5246.1075  |
| 784 | Jamaica | Americas | 1967 | 67.51000 | 1861096   | 6124.7035  |
| 785 | Jamaica | Americas | 1972 | 69.00000 | 1997616   | 7433.8893  |
| 786 | Jamaica | Americas | 1977 | 70.11000 | 2156814   | 6650.1956  |
| 787 | Jamaica | Americas | 1982 | 71.21000 | 2298309   | 6068.0513  |
| 788 | Jamaica | Americas | 1987 | 71.77000 | 2326606   | 6351.2375  |
| 789 | Jamaica | Americas | 1992 | 71.76600 | 2378618   | 7404.9237  |
| 790 | Jamaica | Americas | 1997 | 72.26200 | 2531311   | 7121.9247  |
| 791 | Jamaica | Americas | 2002 | 72.04700 | 2664659   | 6994.7749  |
| 792 | Jamaica | Americas | 2007 | 72.56700 | 2780132   | 7320.8803  |
| 793 | Japan   | Asia     | 1952 | 63.03000 | 86459025  | 3216.9563  |
| 794 | Japan   | Asia     | 1957 | 65.50000 | 91563009  | 4317.6944  |
| 795 | Japan   | Asia     | 1962 | 68.73000 | 95831757  | 6576.6495  |
| 796 | Japan   | Asia     | 1967 | 71.43000 | 100825279 | 9847.7886  |
| 797 | Japan   | Asia     | 1972 | 73.42000 | 107188273 | 14778.7864 |
| 798 | Japan   | Asia     | 1977 | 75.38000 | 113872473 | 16610.3770 |
| 799 | Japan   | Asia     | 1982 | 77.11000 | 118454974 | 19384.1057 |
| 800 | Japan   | Asia     | 1987 | 78.67000 | 122091325 | 22375.9419 |
| 801 | Japan   | Asia     | 1992 | 79.36000 | 124329269 | 26824.8951 |
| 802 | Japan   | Asia     | 1997 | 80.69000 | 125956499 | 28816.5850 |
| 803 | Japan   | Asia     | 2002 | 82.00000 | 127065841 | 28604.5919 |
| 804 | Japan   | Asia     | 2007 | 82.60300 | 127467972 | 31656.0681 |
| 805 | Jordan  | Asia     | 1952 | 43.15800 | 607914    | 1546.9078  |
| 806 | Jordan  | Asia     | 1957 | 45.66900 | 746559    | 1886.0806  |
| 807 | Jordan  | Asia     | 1962 | 48.12600 | 933559    | 2348.0092  |
| 808 | Jordan  | Asia     | 1967 | 51.62900 | 1255058   | 2741.7963  |
| 809 | Jordan  | Asia     | 1972 | 56.52800 | 1613551   | 2110.8563  |
| 810 | Jordan  | Asia     | 1977 | 61.13400 | 1937652   | 2852.3516  |
| 811 | Jordan  | Asia     | 1982 | 63.73900 | 2347031   | 4161.4160  |
| 812 | Jordan  | Asia     | 1987 | 65.86900 | 2820042   | 4448.6799  |
| 813 | Jordan  | Asia     | 1992 | 68.01500 | 3867409   | 3431.5936  |
| 814 | Jordan  | Asia     | 1997 | 69.77200 | 4526235   | 3645.3796  |
| 815 | Jordan  | Asia     | 2002 | 71.26300 | 5307470   | 3844.9172  |
| 816 | Jordan  | Asia     | 2007 | 72.53500 | 6053193   | 4519.4612  |
| 817 | Kenya   | Africa   | 1952 | 42.27000 | 6464046   | 853.5409   |
| 818 | Kenya   | Africa   | 1957 | 44.68600 | 7454779   | 944.4383   |
| 819 | Kenya   | Africa   | 1962 | 47.94900 | 8678557   | 896.9664   |
| 820 | Kenya   | Africa   | 1967 | 50.65400 | 10191512  | 1056.7365  |

|     |                  |        |      |          |          |             |
|-----|------------------|--------|------|----------|----------|-------------|
| 821 | Kenya            | Africa | 1972 | 53.55900 | 12044785 | 1222.3600   |
| 822 | Kenya            | Africa | 1977 | 56.15500 | 14500404 | 1267.6132   |
| 823 | Kenya            | Africa | 1982 | 58.76600 | 17661452 | 1348.2258   |
| 824 | Kenya            | Africa | 1987 | 59.33900 | 21198082 | 1361.9369   |
| 825 | Kenya            | Africa | 1992 | 59.28500 | 25020539 | 1341.9217   |
| 826 | Kenya            | Africa | 1997 | 54.40700 | 28263827 | 1360.4850   |
| 827 | Kenya            | Africa | 2002 | 50.99200 | 31386842 | 1287.5147   |
| 828 | Kenya            | Africa | 2007 | 54.11000 | 35610177 | 1463.2493   |
| 829 | Korea, Dem. Rep. | Asia   | 1952 | 50.05600 | 8865488  | 1088.2778   |
| 830 | Korea, Dem. Rep. | Asia   | 1957 | 54.08100 | 9411381  | 1571.1347   |
| 831 | Korea, Dem. Rep. | Asia   | 1962 | 56.65600 | 10917494 | 1621.6936   |
| 832 | Korea, Dem. Rep. | Asia   | 1967 | 59.94200 | 12617009 | 2143.5406   |
| 833 | Korea, Dem. Rep. | Asia   | 1972 | 63.98300 | 14781241 | 3701.6215   |
| 834 | Korea, Dem. Rep. | Asia   | 1977 | 67.15900 | 16325320 | 4106.3012   |
| 835 | Korea, Dem. Rep. | Asia   | 1982 | 69.10000 | 17647518 | 4106.5253   |
| 836 | Korea, Dem. Rep. | Asia   | 1987 | 70.64700 | 19067554 | 4106.4923   |
| 837 | Korea, Dem. Rep. | Asia   | 1992 | 69.97800 | 20711375 | 3726.0635   |
| 838 | Korea, Dem. Rep. | Asia   | 1997 | 67.72700 | 21585105 | 1690.7568   |
| 839 | Korea, Dem. Rep. | Asia   | 2002 | 66.66200 | 22215365 | 1646.7582   |
| 840 | Korea, Dem. Rep. | Asia   | 2007 | 67.29700 | 23301725 | 1593.0655   |
| 841 | Korea, Rep.      | Asia   | 1952 | 47.45300 | 20947571 | 1030.5922   |
| 842 | Korea, Rep.      | Asia   | 1957 | 52.68100 | 22611552 | 1487.5935   |
| 843 | Korea, Rep.      | Asia   | 1962 | 55.29200 | 26420307 | 1536.3444   |
| 844 | Korea, Rep.      | Asia   | 1967 | 57.71600 | 30131000 | 2029.2281   |
| 845 | Korea, Rep.      | Asia   | 1972 | 62.61200 | 33505000 | 3030.8767   |
| 846 | Korea, Rep.      | Asia   | 1977 | 64.76600 | 36436000 | 4657.2210   |
| 847 | Korea, Rep.      | Asia   | 1982 | 67.12300 | 39326000 | 5622.9425   |
| 848 | Korea, Rep.      | Asia   | 1987 | 69.81000 | 41622000 | 8533.0888   |
| 849 | Korea, Rep.      | Asia   | 1992 | 72.24400 | 43805450 | 12104.2787  |
| 850 | Korea, Rep.      | Asia   | 1997 | 74.64700 | 46173816 | 15993.5280  |
| 851 | Korea, Rep.      | Asia   | 2002 | 77.04500 | 47969150 | 19233.9882  |
| 852 | Korea, Rep.      | Asia   | 2007 | 78.62300 | 49044790 | 23348.1397  |
| 853 | Kuwait           | Asia   | 1952 | 55.56500 | 160000   | 108382.3529 |
| 854 | Kuwait           | Asia   | 1957 | 58.03300 | 212846   | 113523.1329 |
| 855 | Kuwait           | Asia   | 1962 | 60.47000 | 358266   | 95458.1118  |
| 856 | Kuwait           | Asia   | 1967 | 64.62400 | 575003   | 80894.8833  |
| 857 | Kuwait           | Asia   | 1972 | 67.71200 | 841934   | 109347.8670 |
| 858 | Kuwait           | Asia   | 1977 | 69.34300 | 1140357  | 59265.4771  |
| 859 | Kuwait           | Asia   | 1982 | 71.30900 | 1497494  | 31354.0357  |
| 860 | Kuwait           | Asia   | 1987 | 74.17400 | 1891487  | 28118.4300  |
| 861 | Kuwait           | Asia   | 1992 | 75.19000 | 1418095  | 34932.9196  |
| 862 | Kuwait           | Asia   | 1997 | 76.15600 | 1765345  | 40300.6200  |
| 863 | Kuwait           | Asia   | 2002 | 76.90400 | 2111561  | 35110.1057  |

|     |         |        |      |          |         |            |
|-----|---------|--------|------|----------|---------|------------|
| 864 | Kuwait  | Asia   | 2007 | 77.58800 | 2505559 | 47306.9898 |
| 865 | Lebanon | Asia   | 1952 | 55.92800 | 1439529 | 4834.8041  |
| 866 | Lebanon | Asia   | 1957 | 59.48900 | 1647412 | 6089.7869  |
| 867 | Lebanon | Asia   | 1962 | 62.09400 | 1886848 | 5714.5606  |
| 868 | Lebanon | Asia   | 1967 | 63.87000 | 2186894 | 6006.9830  |
| 869 | Lebanon | Asia   | 1972 | 65.42100 | 2680018 | 7486.3843  |
| 870 | Lebanon | Asia   | 1977 | 66.09900 | 3115787 | 8659.6968  |
| 871 | Lebanon | Asia   | 1982 | 66.98300 | 3086876 | 7640.5195  |
| 872 | Lebanon | Asia   | 1987 | 67.92600 | 3089353 | 5377.0913  |
| 873 | Lebanon | Asia   | 1992 | 69.29200 | 3219994 | 6890.8069  |
| 874 | Lebanon | Asia   | 1997 | 70.26500 | 3430388 | 8754.9639  |
| 875 | Lebanon | Asia   | 2002 | 71.02800 | 3677780 | 9313.9388  |
| 876 | Lebanon | Asia   | 2007 | 71.99300 | 3921278 | 10461.0587 |
| 877 | Lesotho | Africa | 1952 | 42.13800 | 748747  | 298.8462   |
| 878 | Lesotho | Africa | 1957 | 45.04700 | 813338  | 335.9971   |
| 879 | Lesotho | Africa | 1962 | 47.74700 | 893143  | 411.8006   |
| 880 | Lesotho | Africa | 1967 | 48.49200 | 996380  | 498.6390   |
| 881 | Lesotho | Africa | 1972 | 49.76700 | 1116779 | 496.5816   |
| 882 | Lesotho | Africa | 1977 | 52.20800 | 1251524 | 745.3695   |
| 883 | Lesotho | Africa | 1982 | 55.07800 | 1411807 | 797.2631   |
| 884 | Lesotho | Africa | 1987 | 57.18000 | 1599200 | 773.9932   |
| 885 | Lesotho | Africa | 1992 | 59.68500 | 1803195 | 977.4863   |
| 886 | Lesotho | Africa | 1997 | 55.55800 | 1982823 | 1186.1480  |
| 887 | Lesotho | Africa | 2002 | 44.59300 | 2046772 | 1275.1846  |
| 888 | Lesotho | Africa | 2007 | 42.59200 | 2012649 | 1569.3314  |
| 889 | Liberia | Africa | 1952 | 38.48000 | 863308  | 575.5730   |
| 890 | Liberia | Africa | 1957 | 39.48600 | 975950  | 620.9700   |
| 891 | Liberia | Africa | 1962 | 40.50200 | 1112796 | 634.1952   |
| 892 | Liberia | Africa | 1967 | 41.53600 | 1279406 | 713.6036   |
| 893 | Liberia | Africa | 1972 | 42.61400 | 1482628 | 803.0055   |
| 894 | Liberia | Africa | 1977 | 43.76400 | 1703617 | 640.3224   |
| 895 | Liberia | Africa | 1982 | 44.85200 | 1956875 | 572.1996   |
| 896 | Liberia | Africa | 1987 | 46.02700 | 2269414 | 506.1139   |
| 897 | Liberia | Africa | 1992 | 40.80200 | 1912974 | 636.6229   |
| 898 | Liberia | Africa | 1997 | 42.22100 | 2200725 | 609.1740   |
| 899 | Liberia | Africa | 2002 | 43.75300 | 2814651 | 531.4824   |
| 900 | Liberia | Africa | 2007 | 45.67800 | 3193942 | 414.5073   |
| 901 | Libya   | Africa | 1952 | 42.72300 | 1019729 | 2387.5481  |
| 902 | Libya   | Africa | 1957 | 45.28900 | 1201578 | 3448.2844  |
| 903 | Libya   | Africa | 1962 | 47.80800 | 1441863 | 6757.0308  |
| 904 | Libya   | Africa | 1967 | 50.22700 | 1759224 | 18772.7517 |
| 905 | Libya   | Africa | 1972 | 52.77300 | 2183877 | 21011.4972 |
| 906 | Libya   | Africa | 1977 | 57.44200 | 2721783 | 21951.2118 |

|     |            |        |      |          |          |            |
|-----|------------|--------|------|----------|----------|------------|
| 907 | Libya      | Africa | 1982 | 62.15500 | 3344074  | 17364.2754 |
| 908 | Libya      | Africa | 1987 | 66.23400 | 3799845  | 11770.5898 |
| 909 | Libya      | Africa | 1992 | 68.75500 | 4364501  | 9640.1385  |
| 910 | Libya      | Africa | 1997 | 71.55500 | 4759670  | 9467.4461  |
| 911 | Libya      | Africa | 2002 | 72.73700 | 5368585  | 9534.6775  |
| 912 | Libya      | Africa | 2007 | 73.95200 | 6036914  | 12057.4993 |
| 913 | Madagascar | Africa | 1952 | 36.68100 | 4762912  | 1443.0117  |
| 914 | Madagascar | Africa | 1957 | 38.86500 | 5181679  | 1589.2027  |
| 915 | Madagascar | Africa | 1962 | 40.84800 | 5703324  | 1643.3871  |
| 916 | Madagascar | Africa | 1967 | 42.88100 | 6334556  | 1634.0473  |
| 917 | Madagascar | Africa | 1972 | 44.85100 | 7082430  | 1748.5630  |
| 918 | Madagascar | Africa | 1977 | 46.88100 | 8007166  | 1544.2286  |
| 919 | Madagascar | Africa | 1982 | 48.96900 | 9171477  | 1302.8787  |
| 920 | Madagascar | Africa | 1987 | 49.35000 | 10568642 | 1155.4419  |
| 921 | Madagascar | Africa | 1992 | 52.21400 | 12210395 | 1040.6762  |
| 922 | Madagascar | Africa | 1997 | 54.97800 | 14165114 | 986.2959   |
| 923 | Madagascar | Africa | 2002 | 57.28600 | 16473477 | 894.6371   |
| 924 | Madagascar | Africa | 2007 | 59.44300 | 19167654 | 1044.7701  |
| 925 | Malawi     | Africa | 1952 | 36.25600 | 2917802  | 369.1651   |
| 926 | Malawi     | Africa | 1957 | 37.20700 | 3221238  | 416.3698   |
| 927 | Malawi     | Africa | 1962 | 38.41000 | 3628608  | 427.9011   |
| 928 | Malawi     | Africa | 1967 | 39.48700 | 4147252  | 495.5148   |
| 929 | Malawi     | Africa | 1972 | 41.76600 | 4730997  | 584.6220   |
| 930 | Malawi     | Africa | 1977 | 43.76700 | 5637246  | 663.2237   |
| 931 | Malawi     | Africa | 1982 | 45.64200 | 6502825  | 632.8039   |
| 932 | Malawi     | Africa | 1987 | 47.45700 | 7824747  | 635.5174   |
| 933 | Malawi     | Africa | 1992 | 49.42000 | 10014249 | 563.2000   |
| 934 | Malawi     | Africa | 1997 | 47.49500 | 10419991 | 692.2758   |
| 935 | Malawi     | Africa | 2002 | 45.00900 | 11824495 | 665.4231   |
| 936 | Malawi     | Africa | 2007 | 48.30300 | 13327079 | 759.3499   |
| 937 | Malaysia   | Asia   | 1952 | 48.46300 | 6748378  | 1831.1329  |
| 938 | Malaysia   | Asia   | 1957 | 52.10200 | 7739235  | 1810.0670  |
| 939 | Malaysia   | Asia   | 1962 | 55.73700 | 8906385  | 2036.8849  |
| 940 | Malaysia   | Asia   | 1967 | 59.37100 | 10154878 | 2277.7424  |
| 941 | Malaysia   | Asia   | 1972 | 63.01000 | 11441462 | 2849.0948  |
| 942 | Malaysia   | Asia   | 1977 | 65.25600 | 12845381 | 3827.9216  |
| 943 | Malaysia   | Asia   | 1982 | 68.00000 | 14441916 | 4920.3560  |
| 944 | Malaysia   | Asia   | 1987 | 69.50000 | 16331785 | 5249.8027  |
| 945 | Malaysia   | Asia   | 1992 | 70.69300 | 18319502 | 7277.9128  |
| 946 | Malaysia   | Asia   | 1997 | 71.93800 | 20476091 | 10132.9096 |
| 947 | Malaysia   | Asia   | 2002 | 73.04400 | 22662365 | 10206.9779 |
| 948 | Malaysia   | Asia   | 2007 | 74.24100 | 24821286 | 12451.6558 |
| 949 | Mali       | Africa | 1952 | 33.68500 | 3838168  | 452.3370   |

|     |            |          |      |          |          |            |
|-----|------------|----------|------|----------|----------|------------|
| 950 | Mali       | Africa   | 1957 | 35.30700 | 4241884  | 490.3822   |
| 951 | Mali       | Africa   | 1962 | 36.93600 | 4690372  | 496.1743   |
| 952 | Mali       | Africa   | 1967 | 38.48700 | 5212416  | 545.0099   |
| 953 | Mali       | Africa   | 1972 | 39.97700 | 5828158  | 581.3689   |
| 954 | Mali       | Africa   | 1977 | 41.71400 | 6491649  | 686.3953   |
| 955 | Mali       | Africa   | 1982 | 43.91600 | 6998256  | 618.0141   |
| 956 | Mali       | Africa   | 1987 | 46.36400 | 7634008  | 684.1716   |
| 957 | Mali       | Africa   | 1992 | 48.38800 | 8416215  | 739.0144   |
| 958 | Mali       | Africa   | 1997 | 49.90300 | 9384984  | 790.2580   |
| 959 | Mali       | Africa   | 2002 | 51.81800 | 10580176 | 951.4098   |
| 960 | Mali       | Africa   | 2007 | 54.46700 | 12031795 | 1042.5816  |
| 961 | Mauritania | Africa   | 1952 | 40.54300 | 1022556  | 743.1159   |
| 962 | Mauritania | Africa   | 1957 | 42.33800 | 1076852  | 846.1203   |
| 963 | Mauritania | Africa   | 1962 | 44.24800 | 1146757  | 1055.8960  |
| 964 | Mauritania | Africa   | 1967 | 46.28900 | 1230542  | 1421.1452  |
| 965 | Mauritania | Africa   | 1972 | 48.43700 | 1332786  | 1586.8518  |
| 966 | Mauritania | Africa   | 1977 | 50.85200 | 1456688  | 1497.4922  |
| 967 | Mauritania | Africa   | 1982 | 53.59900 | 1622136  | 1481.1502  |
| 968 | Mauritania | Africa   | 1987 | 56.14500 | 1841240  | 1421.6036  |
| 969 | Mauritania | Africa   | 1992 | 58.33300 | 2119465  | 1361.3698  |
| 970 | Mauritania | Africa   | 1997 | 60.43000 | 2444741  | 1483.1361  |
| 971 | Mauritania | Africa   | 2002 | 62.24700 | 2828858  | 1579.0195  |
| 972 | Mauritania | Africa   | 2007 | 64.16400 | 3270065  | 1803.1515  |
| 973 | Mauritius  | Africa   | 1952 | 50.98600 | 516556   | 1967.9557  |
| 974 | Mauritius  | Africa   | 1957 | 58.08900 | 609816   | 2034.0380  |
| 975 | Mauritius  | Africa   | 1962 | 60.24600 | 701016   | 2529.0675  |
| 976 | Mauritius  | Africa   | 1967 | 61.55700 | 789309   | 2475.3876  |
| 977 | Mauritius  | Africa   | 1972 | 62.94400 | 851334   | 2575.4842  |
| 978 | Mauritius  | Africa   | 1977 | 64.93000 | 913025   | 3710.9830  |
| 979 | Mauritius  | Africa   | 1982 | 66.71100 | 992040   | 3688.0377  |
| 980 | Mauritius  | Africa   | 1987 | 68.74000 | 1042663  | 4783.5869  |
| 981 | Mauritius  | Africa   | 1992 | 69.74500 | 1096202  | 6058.2538  |
| 982 | Mauritius  | Africa   | 1997 | 70.73600 | 1149818  | 7425.7053  |
| 983 | Mauritius  | Africa   | 2002 | 71.95400 | 1200206  | 9021.8159  |
| 984 | Mauritius  | Africa   | 2007 | 72.80100 | 1250882  | 10956.9911 |
| 985 | Mexico     | Americas | 1952 | 50.78900 | 30144317 | 3478.1255  |
| 986 | Mexico     | Americas | 1957 | 55.19000 | 35015548 | 4131.5466  |
| 987 | Mexico     | Americas | 1962 | 58.29900 | 41121485 | 4581.6094  |
| 988 | Mexico     | Americas | 1967 | 60.11000 | 47995559 | 5754.7339  |
| 989 | Mexico     | Americas | 1972 | 62.36100 | 55984294 | 6809.4067  |
| 990 | Mexico     | Americas | 1977 | 65.03200 | 63759976 | 7674.9291  |
| 991 | Mexico     | Americas | 1982 | 67.40500 | 71640904 | 9611.1475  |
| 992 | Mexico     | Americas | 1987 | 69.49800 | 80122492 | 8688.1560  |

|      |            |          |      |          |           |            |
|------|------------|----------|------|----------|-----------|------------|
| 993  | Mexico     | Americas | 1992 | 71.45500 | 88111030  | 9472.3843  |
| 994  | Mexico     | Americas | 1997 | 73.67000 | 95895146  | 9767.2975  |
| 995  | Mexico     | Americas | 2002 | 74.90200 | 102479927 | 10742.4405 |
| 996  | Mexico     | Americas | 2007 | 76.19500 | 108700891 | 11977.5750 |
| 997  | Mongolia   | Asia     | 1952 | 42.24400 | 800663    | 786.5669   |
| 998  | Mongolia   | Asia     | 1957 | 45.24800 | 882134    | 912.6626   |
| 999  | Mongolia   | Asia     | 1962 | 48.25100 | 1010280   | 1056.3540  |
| 1000 | Mongolia   | Asia     | 1967 | 51.25300 | 1149500   | 1226.0411  |
| 1001 | Mongolia   | Asia     | 1972 | 53.75400 | 1320500   | 1421.7420  |
| 1002 | Mongolia   | Asia     | 1977 | 55.49100 | 1528000   | 1647.5117  |
| 1003 | Mongolia   | Asia     | 1982 | 57.48900 | 1756032   | 2000.6031  |
| 1004 | Mongolia   | Asia     | 1987 | 60.22200 | 2015133   | 2338.0083  |
| 1005 | Mongolia   | Asia     | 1992 | 61.27100 | 2312802   | 1785.4020  |
| 1006 | Mongolia   | Asia     | 1997 | 63.62500 | 2494803   | 1902.2521  |
| 1007 | Mongolia   | Asia     | 2002 | 65.03300 | 2674234   | 2140.7393  |
| 1008 | Mongolia   | Asia     | 2007 | 66.80300 | 2874127   | 3095.7723  |
| 1009 | Montenegro | Europe   | 1952 | 59.16400 | 413834    | 2647.5856  |
| 1010 | Montenegro | Europe   | 1957 | 61.44800 | 442829    | 3682.2599  |
| 1011 | Montenegro | Europe   | 1962 | 63.72800 | 474528    | 4649.5938  |
| 1012 | Montenegro | Europe   | 1967 | 67.17800 | 501035    | 5907.8509  |
| 1013 | Montenegro | Europe   | 1972 | 70.63600 | 527678    | 7778.4140  |
| 1014 | Montenegro | Europe   | 1977 | 73.06600 | 560073    | 9595.9299  |
| 1015 | Montenegro | Europe   | 1982 | 74.10100 | 562548    | 11222.5876 |
| 1016 | Montenegro | Europe   | 1987 | 74.86500 | 569473    | 11732.5102 |
| 1017 | Montenegro | Europe   | 1992 | 75.43500 | 621621    | 7003.3390  |
| 1018 | Montenegro | Europe   | 1997 | 75.44500 | 692651    | 6465.6133  |
| 1019 | Montenegro | Europe   | 2002 | 73.98100 | 720230    | 6557.1943  |
| 1020 | Montenegro | Europe   | 2007 | 74.54300 | 684736    | 9253.8961  |
| 1021 | Morocco    | Africa   | 1952 | 42.87300 | 9939217   | 1688.2036  |
| 1022 | Morocco    | Africa   | 1957 | 45.42300 | 11406350  | 1642.0023  |
| 1023 | Morocco    | Africa   | 1962 | 47.92400 | 13056604  | 1566.3535  |
| 1024 | Morocco    | Africa   | 1967 | 50.33500 | 14770296  | 1711.0448  |
| 1025 | Morocco    | Africa   | 1972 | 52.86200 | 16660670  | 1930.1950  |
| 1026 | Morocco    | Africa   | 1977 | 55.73000 | 18396941  | 2370.6200  |
| 1027 | Morocco    | Africa   | 1982 | 59.65000 | 20198730  | 2702.6204  |
| 1028 | Morocco    | Africa   | 1987 | 62.67700 | 22987397  | 2755.0470  |
| 1029 | Morocco    | Africa   | 1992 | 65.39300 | 25798239  | 2948.0473  |
| 1030 | Morocco    | Africa   | 1997 | 67.66000 | 28529501  | 2982.1019  |
| 1031 | Morocco    | Africa   | 2002 | 69.61500 | 31167783  | 3258.4956  |
| 1032 | Morocco    | Africa   | 2007 | 71.16400 | 33757175  | 3820.1752  |
| 1033 | Mozambique | Africa   | 1952 | 31.28600 | 6446316   | 468.5260   |
| 1034 | Mozambique | Africa   | 1957 | 33.77900 | 7038035   | 495.5868   |
| 1035 | Mozambique | Africa   | 1962 | 36.16100 | 7788944   | 556.6864   |

|      |            |        |      |          |          |           |
|------|------------|--------|------|----------|----------|-----------|
| 1036 | Mozambique | Africa | 1967 | 38.11300 | 8680909  | 566.6692  |
| 1037 | Mozambique | Africa | 1972 | 40.32800 | 9809596  | 724.9178  |
| 1038 | Mozambique | Africa | 1977 | 42.49500 | 11127868 | 502.3197  |
| 1039 | Mozambique | Africa | 1982 | 42.79500 | 12587223 | 462.2114  |
| 1040 | Mozambique | Africa | 1987 | 42.86100 | 12891952 | 389.8762  |
| 1041 | Mozambique | Africa | 1992 | 44.28400 | 13160731 | 410.8968  |
| 1042 | Mozambique | Africa | 1997 | 46.34400 | 16603334 | 472.3461  |
| 1043 | Mozambique | Africa | 2002 | 44.02600 | 18473780 | 633.6179  |
| 1044 | Mozambique | Africa | 2007 | 42.08200 | 19951656 | 823.6856  |
| 1045 | Myanmar    | Asia   | 1952 | 36.31900 | 20092996 | 331.0000  |
| 1046 | Myanmar    | Asia   | 1957 | 41.90500 | 21731844 | 350.0000  |
| 1047 | Myanmar    | Asia   | 1962 | 45.10800 | 23634436 | 388.0000  |
| 1048 | Myanmar    | Asia   | 1967 | 49.37900 | 25870271 | 349.0000  |
| 1049 | Myanmar    | Asia   | 1972 | 53.07000 | 28466390 | 357.0000  |
| 1050 | Myanmar    | Asia   | 1977 | 56.05900 | 31528087 | 371.0000  |
| 1051 | Myanmar    | Asia   | 1982 | 58.05600 | 34680442 | 424.0000  |
| 1052 | Myanmar    | Asia   | 1987 | 58.33900 | 38028578 | 385.0000  |
| 1053 | Myanmar    | Asia   | 1992 | 59.32000 | 40546538 | 347.0000  |
| 1054 | Myanmar    | Asia   | 1997 | 60.32800 | 43247867 | 415.0000  |
| 1055 | Myanmar    | Asia   | 2002 | 59.90800 | 45598081 | 611.0000  |
| 1056 | Myanmar    | Asia   | 2007 | 62.06900 | 47761980 | 944.0000  |
| 1057 | Namibia    | Africa | 1952 | 41.72500 | 485831   | 2423.7804 |
| 1058 | Namibia    | Africa | 1957 | 45.22600 | 548080   | 2621.4481 |
| 1059 | Namibia    | Africa | 1962 | 48.38600 | 621392   | 3173.2156 |
| 1060 | Namibia    | Africa | 1967 | 51.15900 | 706640   | 3793.6948 |
| 1061 | Namibia    | Africa | 1972 | 53.86700 | 821782   | 3746.0809 |
| 1062 | Namibia    | Africa | 1977 | 56.43700 | 977026   | 3876.4860 |
| 1063 | Namibia    | Africa | 1982 | 58.96800 | 1099010  | 4191.1005 |
| 1064 | Namibia    | Africa | 1987 | 60.83500 | 1278184  | 3693.7313 |
| 1065 | Namibia    | Africa | 1992 | 61.99900 | 1554253  | 3804.5380 |
| 1066 | Namibia    | Africa | 1997 | 58.90900 | 1774766  | 3899.5243 |
| 1067 | Namibia    | Africa | 2002 | 51.47900 | 1972153  | 4072.3248 |
| 1068 | Namibia    | Africa | 2007 | 52.90600 | 2055080  | 4811.0604 |
| 1069 | Nepal      | Asia   | 1952 | 36.15700 | 9182536  | 545.8657  |
| 1070 | Nepal      | Asia   | 1957 | 37.68600 | 9682338  | 597.9364  |
| 1071 | Nepal      | Asia   | 1962 | 39.39300 | 10332057 | 652.3969  |
| 1072 | Nepal      | Asia   | 1967 | 41.47200 | 11261690 | 676.4422  |
| 1073 | Nepal      | Asia   | 1972 | 43.97100 | 12412593 | 674.7881  |
| 1074 | Nepal      | Asia   | 1977 | 46.74800 | 13933198 | 694.1124  |
| 1075 | Nepal      | Asia   | 1982 | 49.59400 | 15796314 | 718.3731  |
| 1076 | Nepal      | Asia   | 1987 | 52.53700 | 17917180 | 775.6325  |
| 1077 | Nepal      | Asia   | 1992 | 55.72700 | 20326209 | 897.7404  |
| 1078 | Nepal      | Asia   | 1997 | 59.42600 | 23001113 | 1010.8921 |

|      |             |          |      |          |          |            |
|------|-------------|----------|------|----------|----------|------------|
| 1079 | Nepal       | Asia     | 2002 | 61.34000 | 25873917 | 1057.2063  |
| 1080 | Nepal       | Asia     | 2007 | 63.78500 | 28901790 | 1091.3598  |
| 1081 | Netherlands | Europe   | 1952 | 72.13000 | 10381988 | 8941.5719  |
| 1082 | Netherlands | Europe   | 1957 | 72.99000 | 11026383 | 11276.1934 |
| 1083 | Netherlands | Europe   | 1962 | 73.23000 | 11805689 | 12790.8496 |
| 1084 | Netherlands | Europe   | 1967 | 73.82000 | 12596822 | 15363.2514 |
| 1085 | Netherlands | Europe   | 1972 | 73.75000 | 13329874 | 18794.7457 |
| 1086 | Netherlands | Europe   | 1977 | 75.24000 | 13852989 | 21209.0592 |
| 1087 | Netherlands | Europe   | 1982 | 76.05000 | 14310401 | 21399.4605 |
| 1088 | Netherlands | Europe   | 1987 | 76.83000 | 14665278 | 23651.3236 |
| 1089 | Netherlands | Europe   | 1992 | 77.42000 | 15174244 | 26790.9496 |
| 1090 | Netherlands | Europe   | 1997 | 78.03000 | 15604464 | 30246.1306 |
| 1091 | Netherlands | Europe   | 2002 | 78.53000 | 16122830 | 33724.7578 |
| 1092 | Netherlands | Europe   | 2007 | 79.76200 | 16570613 | 36797.9333 |
| 1093 | New Zealand | Oceania  | 1952 | 69.39000 | 1994794  | 10556.5757 |
| 1094 | New Zealand | Oceania  | 1957 | 70.26000 | 2229407  | 12247.3953 |
| 1095 | New Zealand | Oceania  | 1962 | 71.24000 | 2488550  | 13175.6780 |
| 1096 | New Zealand | Oceania  | 1967 | 71.52000 | 2728150  | 14463.9189 |
| 1097 | New Zealand | Oceania  | 1972 | 71.89000 | 2929100  | 16046.0373 |
| 1098 | New Zealand | Oceania  | 1977 | 72.22000 | 3164900  | 16233.7177 |
| 1099 | New Zealand | Oceania  | 1982 | 73.84000 | 3210650  | 17632.4104 |
| 1100 | New Zealand | Oceania  | 1987 | 74.32000 | 3317166  | 19007.1913 |
| 1101 | New Zealand | Oceania  | 1992 | 76.33000 | 3437674  | 18363.3249 |
| 1102 | New Zealand | Oceania  | 1997 | 77.55000 | 3676187  | 21050.4138 |
| 1103 | New Zealand | Oceania  | 2002 | 79.11000 | 3908037  | 23189.8014 |
| 1104 | New Zealand | Oceania  | 2007 | 80.20400 | 4115771  | 25185.0091 |
| 1105 | Nicaragua   | Americas | 1952 | 42.31400 | 1165790  | 3112.3639  |
| 1106 | Nicaragua   | Americas | 1957 | 45.43200 | 1358828  | 3457.4159  |
| 1107 | Nicaragua   | Americas | 1962 | 48.63200 | 1590597  | 3634.3644  |
| 1108 | Nicaragua   | Americas | 1967 | 51.88400 | 1865490  | 4643.3935  |
| 1109 | Nicaragua   | Americas | 1972 | 55.15100 | 2182908  | 4688.5933  |
| 1110 | Nicaragua   | Americas | 1977 | 57.47000 | 2554598  | 5486.3711  |
| 1111 | Nicaragua   | Americas | 1982 | 59.29800 | 2979423  | 3470.3382  |
| 1112 | Nicaragua   | Americas | 1987 | 62.00800 | 3344353  | 2955.9844  |
| 1113 | Nicaragua   | Americas | 1992 | 65.84300 | 4017939  | 2170.1517  |
| 1114 | Nicaragua   | Americas | 1997 | 68.42600 | 4609572  | 2253.0230  |
| 1115 | Nicaragua   | Americas | 2002 | 70.83600 | 5146848  | 2474.5488  |
| 1116 | Nicaragua   | Americas | 2007 | 72.89900 | 5675356  | 2749.3210  |
| 1117 | Niger       | Africa   | 1952 | 37.44400 | 3379468  | 761.8794   |
| 1118 | Niger       | Africa   | 1957 | 38.59800 | 3692184  | 835.5234   |
| 1119 | Niger       | Africa   | 1962 | 39.48700 | 4076008  | 997.7661   |
| 1120 | Niger       | Africa   | 1967 | 40.11800 | 4534062  | 1054.3849  |
| 1121 | Niger       | Africa   | 1972 | 40.54600 | 5060262  | 954.2092   |

|      |         |        |      |          |           |            |
|------|---------|--------|------|----------|-----------|------------|
| 1122 | Niger   | Africa | 1977 | 41.29100 | 5682086   | 808.8971   |
| 1123 | Niger   | Africa | 1982 | 42.59800 | 6437188   | 909.7221   |
| 1124 | Niger   | Africa | 1987 | 44.55500 | 7332638   | 668.3000   |
| 1125 | Niger   | Africa | 1992 | 47.39100 | 8392818   | 581.1827   |
| 1126 | Niger   | Africa | 1997 | 51.31300 | 9666252   | 580.3052   |
| 1127 | Niger   | Africa | 2002 | 54.49600 | 11140655  | 601.0745   |
| 1128 | Niger   | Africa | 2007 | 56.86700 | 12894865  | 619.6769   |
| 1129 | Nigeria | Africa | 1952 | 36.32400 | 33119096  | 1077.2819  |
| 1130 | Nigeria | Africa | 1957 | 37.80200 | 37173340  | 1100.5926  |
| 1131 | Nigeria | Africa | 1962 | 39.36000 | 41871351  | 1150.9275  |
| 1132 | Nigeria | Africa | 1967 | 41.04000 | 47287752  | 1014.5141  |
| 1133 | Nigeria | Africa | 1972 | 42.82100 | 53740085  | 1698.3888  |
| 1134 | Nigeria | Africa | 1977 | 44.51400 | 62209173  | 1981.9518  |
| 1135 | Nigeria | Africa | 1982 | 45.82600 | 73039376  | 1576.9738  |
| 1136 | Nigeria | Africa | 1987 | 46.88600 | 81551520  | 1385.0296  |
| 1137 | Nigeria | Africa | 1992 | 47.47200 | 93364244  | 1619.8482  |
| 1138 | Nigeria | Africa | 1997 | 47.46400 | 106207839 | 1624.9413  |
| 1139 | Nigeria | Africa | 2002 | 46.60800 | 119901274 | 1615.2864  |
| 1140 | Nigeria | Africa | 2007 | 46.85900 | 135031164 | 2013.9773  |
| 1141 | Norway  | Europe | 1952 | 72.67000 | 3327728   | 10095.4217 |
| 1142 | Norway  | Europe | 1957 | 73.44000 | 3491938   | 11653.9730 |
| 1143 | Norway  | Europe | 1962 | 73.47000 | 3638919   | 13450.4015 |
| 1144 | Norway  | Europe | 1967 | 74.08000 | 3786019   | 16361.8765 |
| 1145 | Norway  | Europe | 1972 | 74.34000 | 3933004   | 18965.0555 |
| 1146 | Norway  | Europe | 1977 | 75.37000 | 4043205   | 23311.3494 |
| 1147 | Norway  | Europe | 1982 | 75.97000 | 4114787   | 26298.6353 |
| 1148 | Norway  | Europe | 1987 | 75.89000 | 4186147   | 31540.9748 |
| 1149 | Norway  | Europe | 1992 | 77.32000 | 4286357   | 33965.6611 |
| 1150 | Norway  | Europe | 1997 | 78.32000 | 4405672   | 41283.1643 |
| 1151 | Norway  | Europe | 2002 | 79.05000 | 4535591   | 44683.9753 |
| 1152 | Norway  | Europe | 2007 | 80.19600 | 4627926   | 49357.1902 |
| 1153 | Oman    | Asia   | 1952 | 37.57800 | 507833    | 1828.2303  |
| 1154 | Oman    | Asia   | 1957 | 40.08000 | 561977    | 2242.7466  |
| 1155 | Oman    | Asia   | 1962 | 43.16500 | 628164    | 2924.6381  |
| 1156 | Oman    | Asia   | 1967 | 46.98800 | 714775    | 4720.9427  |
| 1157 | Oman    | Asia   | 1972 | 52.14300 | 829050    | 10618.0385 |
| 1158 | Oman    | Asia   | 1977 | 57.36700 | 1004533   | 11848.3439 |
| 1159 | Oman    | Asia   | 1982 | 62.72800 | 1301048   | 12954.7910 |
| 1160 | Oman    | Asia   | 1987 | 67.73400 | 1593882   | 18115.2231 |
| 1161 | Oman    | Asia   | 1992 | 71.19700 | 1915208   | 18616.7069 |
| 1162 | Oman    | Asia   | 1997 | 72.49900 | 2283635   | 19702.0558 |
| 1163 | Oman    | Asia   | 2002 | 74.19300 | 2713462   | 19774.8369 |
| 1164 | Oman    | Asia   | 2007 | 75.64000 | 3204897   | 22316.1929 |

|      |          |          |      |          |           |           |
|------|----------|----------|------|----------|-----------|-----------|
| 1165 | Pakistan | Asia     | 1952 | 43.43600 | 41346560  | 684.5971  |
| 1166 | Pakistan | Asia     | 1957 | 45.55700 | 46679944  | 747.0835  |
| 1167 | Pakistan | Asia     | 1962 | 47.67000 | 53100671  | 803.3427  |
| 1168 | Pakistan | Asia     | 1967 | 49.80000 | 60641899  | 942.4083  |
| 1169 | Pakistan | Asia     | 1972 | 51.92900 | 69325921  | 1049.9390 |
| 1170 | Pakistan | Asia     | 1977 | 54.04300 | 78152686  | 1175.9212 |
| 1171 | Pakistan | Asia     | 1982 | 56.15800 | 91462088  | 1443.4298 |
| 1172 | Pakistan | Asia     | 1987 | 58.24500 | 105186881 | 1704.6866 |
| 1173 | Pakistan | Asia     | 1992 | 60.83800 | 120065004 | 1971.8295 |
| 1174 | Pakistan | Asia     | 1997 | 61.81800 | 135564834 | 2049.3505 |
| 1175 | Pakistan | Asia     | 2002 | 63.61000 | 153403524 | 2092.7124 |
| 1176 | Pakistan | Asia     | 2007 | 65.48300 | 169270617 | 2605.9476 |
| 1177 | Panama   | Americas | 1952 | 55.19100 | 940080    | 2480.3803 |
| 1178 | Panama   | Americas | 1957 | 59.20100 | 1063506   | 2961.8009 |
| 1179 | Panama   | Americas | 1962 | 61.81700 | 1215725   | 3536.5403 |
| 1180 | Panama   | Americas | 1967 | 64.07100 | 1405486   | 4421.0091 |
| 1181 | Panama   | Americas | 1972 | 66.21600 | 1616384   | 5364.2497 |
| 1182 | Panama   | Americas | 1977 | 68.68100 | 1839782   | 5351.9121 |
| 1183 | Panama   | Americas | 1982 | 70.47200 | 2036305   | 7009.6016 |
| 1184 | Panama   | Americas | 1987 | 71.52300 | 2253639   | 7034.7792 |
| 1185 | Panama   | Americas | 1992 | 72.46200 | 2484997   | 6618.7431 |
| 1186 | Panama   | Americas | 1997 | 73.73800 | 2734531   | 7113.6923 |
| 1187 | Panama   | Americas | 2002 | 74.71200 | 2990875   | 7356.0319 |
| 1188 | Panama   | Americas | 2007 | 75.53700 | 3242173   | 9809.1856 |
| 1189 | Paraguay | Americas | 1952 | 62.64900 | 1555876   | 1952.3087 |
| 1190 | Paraguay | Americas | 1957 | 63.19600 | 1770902   | 2046.1547 |
| 1191 | Paraguay | Americas | 1962 | 64.36100 | 2009813   | 2148.0271 |
| 1192 | Paraguay | Americas | 1967 | 64.95100 | 2287985   | 2299.3763 |
| 1193 | Paraguay | Americas | 1972 | 65.81500 | 2614104   | 2523.3380 |
| 1194 | Paraguay | Americas | 1977 | 66.35300 | 2984494   | 3248.3733 |
| 1195 | Paraguay | Americas | 1982 | 66.87400 | 3366439   | 4258.5036 |
| 1196 | Paraguay | Americas | 1987 | 67.37800 | 3886512   | 3998.8757 |
| 1197 | Paraguay | Americas | 1992 | 68.22500 | 4483945   | 4196.4111 |
| 1198 | Paraguay | Americas | 1997 | 69.40000 | 5154123   | 4247.4003 |
| 1199 | Paraguay | Americas | 2002 | 70.75500 | 5884491   | 3783.6742 |
| 1200 | Paraguay | Americas | 2007 | 71.75200 | 6667147   | 4172.8385 |
| 1201 | Peru     | Americas | 1952 | 43.90200 | 8025700   | 3758.5234 |
| 1202 | Peru     | Americas | 1957 | 46.26300 | 9146100   | 4245.2567 |
| 1203 | Peru     | Americas | 1962 | 49.09600 | 10516500  | 4957.0380 |
| 1204 | Peru     | Americas | 1967 | 51.44500 | 12132200  | 5788.0933 |
| 1205 | Peru     | Americas | 1972 | 55.44800 | 13954700  | 5937.8273 |
| 1206 | Peru     | Americas | 1977 | 58.44700 | 15990099  | 6281.2909 |
| 1207 | Peru     | Americas | 1982 | 61.40600 | 18125129  | 6434.5018 |

|      |             |          |      |          |          |            |
|------|-------------|----------|------|----------|----------|------------|
| 1208 | Peru        | Americas | 1987 | 64.13400 | 20195924 | 6360.9434  |
| 1209 | Peru        | Americas | 1992 | 66.45800 | 22430449 | 4446.3809  |
| 1210 | Peru        | Americas | 1997 | 68.38600 | 24748122 | 5838.3477  |
| 1211 | Peru        | Americas | 2002 | 69.90600 | 26769436 | 5909.0201  |
| 1212 | Peru        | Americas | 2007 | 71.42100 | 28674757 | 7408.9056  |
| 1213 | Philippines | Asia     | 1952 | 47.75200 | 22438691 | 1272.8810  |
| 1214 | Philippines | Asia     | 1957 | 51.33400 | 26072194 | 1547.9448  |
| 1215 | Philippines | Asia     | 1962 | 54.75700 | 30325264 | 1649.5522  |
| 1216 | Philippines | Asia     | 1967 | 56.39300 | 35356600 | 1814.1274  |
| 1217 | Philippines | Asia     | 1972 | 58.06500 | 40850141 | 1989.3741  |
| 1218 | Philippines | Asia     | 1977 | 60.06000 | 46850962 | 2373.2043  |
| 1219 | Philippines | Asia     | 1982 | 62.08200 | 53456774 | 2603.2738  |
| 1220 | Philippines | Asia     | 1987 | 64.15100 | 60017788 | 2189.6350  |
| 1221 | Philippines | Asia     | 1992 | 66.45800 | 67185766 | 2279.3240  |
| 1222 | Philippines | Asia     | 1997 | 68.56400 | 75012988 | 2536.5349  |
| 1223 | Philippines | Asia     | 2002 | 70.30300 | 82995088 | 2650.9211  |
| 1224 | Philippines | Asia     | 2007 | 71.68800 | 91077287 | 3190.4810  |
| 1225 | Poland      | Europe   | 1952 | 61.31000 | 25730551 | 4029.3297  |
| 1226 | Poland      | Europe   | 1957 | 65.77000 | 28235346 | 4734.2530  |
| 1227 | Poland      | Europe   | 1962 | 67.64000 | 30329617 | 5338.7521  |
| 1228 | Poland      | Europe   | 1967 | 69.61000 | 31785378 | 6557.1528  |
| 1229 | Poland      | Europe   | 1972 | 70.85000 | 33039545 | 8006.5070  |
| 1230 | Poland      | Europe   | 1977 | 70.67000 | 34621254 | 9508.1415  |
| 1231 | Poland      | Europe   | 1982 | 71.32000 | 36227381 | 8451.5310  |
| 1232 | Poland      | Europe   | 1987 | 70.98000 | 37740710 | 9082.3512  |
| 1233 | Poland      | Europe   | 1992 | 70.99000 | 38370697 | 7738.8812  |
| 1234 | Poland      | Europe   | 1997 | 72.75000 | 38654957 | 10159.5837 |
| 1235 | Poland      | Europe   | 2002 | 74.67000 | 38625976 | 12002.2391 |
| 1236 | Poland      | Europe   | 2007 | 75.56300 | 38518241 | 15389.9247 |
| 1237 | Portugal    | Europe   | 1952 | 59.82000 | 8526050  | 3068.3199  |
| 1238 | Portugal    | Europe   | 1957 | 61.51000 | 8817650  | 3774.5717  |
| 1239 | Portugal    | Europe   | 1962 | 64.39000 | 9019800  | 4727.9549  |
| 1240 | Portugal    | Europe   | 1967 | 66.60000 | 9103000  | 6361.5180  |
| 1241 | Portugal    | Europe   | 1972 | 69.26000 | 8970450  | 9022.2474  |
| 1242 | Portugal    | Europe   | 1977 | 70.41000 | 9662600  | 10172.4857 |
| 1243 | Portugal    | Europe   | 1982 | 72.77000 | 9859650  | 11753.8429 |
| 1244 | Portugal    | Europe   | 1987 | 74.06000 | 9915289  | 13039.3088 |
| 1245 | Portugal    | Europe   | 1992 | 74.86000 | 9927680  | 16207.2666 |
| 1246 | Portugal    | Europe   | 1997 | 75.97000 | 10156415 | 17641.0316 |
| 1247 | Portugal    | Europe   | 2002 | 77.29000 | 10433867 | 19970.9079 |
| 1248 | Portugal    | Europe   | 2007 | 78.09800 | 10642836 | 20509.6478 |
| 1249 | Puerto Rico | Americas | 1952 | 64.28000 | 2227000  | 3081.9598  |
| 1250 | Puerto Rico | Americas | 1957 | 68.54000 | 2260000  | 3907.1562  |

|      |             |          |      |          |          |            |
|------|-------------|----------|------|----------|----------|------------|
| 1251 | Puerto Rico | Americas | 1962 | 69.62000 | 2448046  | 5108.3446  |
| 1252 | Puerto Rico | Americas | 1967 | 71.10000 | 2648961  | 6929.2777  |
| 1253 | Puerto Rico | Americas | 1972 | 72.16000 | 2847132  | 9123.0417  |
| 1254 | Puerto Rico | Americas | 1977 | 73.44000 | 3080828  | 9770.5249  |
| 1255 | Puerto Rico | Americas | 1982 | 73.75000 | 3279001  | 10330.9891 |
| 1256 | Puerto Rico | Americas | 1987 | 74.63000 | 3444468  | 12281.3419 |
| 1257 | Puerto Rico | Americas | 1992 | 73.91100 | 3585176  | 14641.5871 |
| 1258 | Puerto Rico | Americas | 1997 | 74.91700 | 3759430  | 16999.4333 |
| 1259 | Puerto Rico | Americas | 2002 | 77.77800 | 3859606  | 18855.6062 |
| 1260 | Puerto Rico | Americas | 2007 | 78.74600 | 3942491  | 19328.7090 |
| 1261 | Reunion     | Africa   | 1952 | 52.72400 | 257700   | 2718.8853  |
| 1262 | Reunion     | Africa   | 1957 | 55.09000 | 308700   | 2769.4518  |
| 1263 | Reunion     | Africa   | 1962 | 57.66600 | 358900   | 3173.7233  |
| 1264 | Reunion     | Africa   | 1967 | 60.54200 | 414024   | 4021.1757  |
| 1265 | Reunion     | Africa   | 1972 | 64.27400 | 461633   | 5047.6586  |
| 1266 | Reunion     | Africa   | 1977 | 67.06400 | 492095   | 4319.8041  |
| 1267 | Reunion     | Africa   | 1982 | 69.88500 | 517810   | 5267.2194  |
| 1268 | Reunion     | Africa   | 1987 | 71.91300 | 562035   | 5303.3775  |
| 1269 | Reunion     | Africa   | 1992 | 73.61500 | 622191   | 6101.2558  |
| 1270 | Reunion     | Africa   | 1997 | 74.77200 | 684810   | 6071.9414  |
| 1271 | Reunion     | Africa   | 2002 | 75.74400 | 743981   | 6316.1652  |
| 1272 | Reunion     | Africa   | 2007 | 76.44200 | 798094   | 7670.1226  |
| 1273 | Romania     | Europe   | 1952 | 61.05000 | 16630000 | 3144.6132  |
| 1274 | Romania     | Europe   | 1957 | 64.10000 | 17829327 | 3943.3702  |
| 1275 | Romania     | Europe   | 1962 | 66.80000 | 18680721 | 4734.9976  |
| 1276 | Romania     | Europe   | 1967 | 66.80000 | 19284814 | 6470.8665  |
| 1277 | Romania     | Europe   | 1972 | 69.21000 | 20662648 | 8011.4144  |
| 1278 | Romania     | Europe   | 1977 | 69.46000 | 21658597 | 9356.3972  |
| 1279 | Romania     | Europe   | 1982 | 69.66000 | 22356726 | 9605.3141  |
| 1280 | Romania     | Europe   | 1987 | 69.53000 | 22686371 | 9696.2733  |
| 1281 | Romania     | Europe   | 1992 | 69.36000 | 22797027 | 6598.4099  |
| 1282 | Romania     | Europe   | 1997 | 69.72000 | 22562458 | 7346.5476  |
| 1283 | Romania     | Europe   | 2002 | 71.32200 | 22404337 | 7885.3601  |
| 1284 | Romania     | Europe   | 2007 | 72.47600 | 22276056 | 10808.4756 |
| 1285 | Rwanda      | Africa   | 1952 | 40.00000 | 2534927  | 493.3239   |
| 1286 | Rwanda      | Africa   | 1957 | 41.50000 | 2822082  | 540.2894   |
| 1287 | Rwanda      | Africa   | 1962 | 43.00000 | 3051242  | 597.4731   |
| 1288 | Rwanda      | Africa   | 1967 | 44.10000 | 3451079  | 510.9637   |
| 1289 | Rwanda      | Africa   | 1972 | 44.60000 | 3992121  | 590.5807   |
| 1290 | Rwanda      | Africa   | 1977 | 45.00000 | 4657072  | 670.0806   |
| 1291 | Rwanda      | Africa   | 1982 | 46.21800 | 5507565  | 881.5706   |
| 1292 | Rwanda      | Africa   | 1987 | 44.02000 | 6349365  | 847.9912   |
| 1293 | Rwanda      | Africa   | 1992 | 23.59900 | 7290203  | 737.0686   |

|      |                       |        |      |          |          |            |
|------|-----------------------|--------|------|----------|----------|------------|
| 1294 | Rwanda                | Africa | 1997 | 36.08700 | 7212583  | 589.9445   |
| 1295 | Rwanda                | Africa | 2002 | 43.41300 | 7852401  | 785.6538   |
| 1296 | Rwanda                | Africa | 2007 | 46.24200 | 8860588  | 863.0885   |
| 1297 | Sao Tome and Principe | Africa | 1952 | 46.47100 | 60011    | 879.5836   |
| 1298 | Sao Tome and Principe | Africa | 1957 | 48.94500 | 61325    | 860.7369   |
| 1299 | Sao Tome and Principe | Africa | 1962 | 51.89300 | 65345    | 1071.5511  |
| 1300 | Sao Tome and Principe | Africa | 1967 | 54.42500 | 70787    | 1384.8406  |
| 1301 | Sao Tome and Principe | Africa | 1972 | 56.48000 | 76595    | 1532.9853  |
| 1302 | Sao Tome and Principe | Africa | 1977 | 58.55000 | 86796    | 1737.5617  |
| 1303 | Sao Tome and Principe | Africa | 1982 | 60.35100 | 98593    | 1890.2181  |
| 1304 | Sao Tome and Principe | Africa | 1987 | 61.72800 | 110812   | 1516.5255  |
| 1305 | Sao Tome and Principe | Africa | 1992 | 62.74200 | 125911   | 1428.7778  |
| 1306 | Sao Tome and Principe | Africa | 1997 | 63.30600 | 145608   | 1339.0760  |
| 1307 | Sao Tome and Principe | Africa | 2002 | 64.33700 | 170372   | 1353.0924  |
| 1308 | Sao Tome and Principe | Africa | 2007 | 65.52800 | 199579   | 1598.4351  |
| 1309 | Saudi Arabia          | Asia   | 1952 | 39.87500 | 4005677  | 6459.5548  |
| 1310 | Saudi Arabia          | Asia   | 1957 | 42.86800 | 4419650  | 8157.5912  |
| 1311 | Saudi Arabia          | Asia   | 1962 | 45.91400 | 4943029  | 11626.4197 |
| 1312 | Saudi Arabia          | Asia   | 1967 | 49.90100 | 5618198  | 16903.0489 |
| 1313 | Saudi Arabia          | Asia   | 1972 | 53.88600 | 6472756  | 24837.4287 |
| 1314 | Saudi Arabia          | Asia   | 1977 | 58.69000 | 8128505  | 34167.7626 |
| 1315 | Saudi Arabia          | Asia   | 1982 | 63.01200 | 11254672 | 33693.1753 |
| 1316 | Saudi Arabia          | Asia   | 1987 | 66.29500 | 14619745 | 21198.2614 |
| 1317 | Saudi Arabia          | Asia   | 1992 | 68.76800 | 16945857 | 24841.6178 |
| 1318 | Saudi Arabia          | Asia   | 1997 | 70.53300 | 21229759 | 20586.6902 |
| 1319 | Saudi Arabia          | Asia   | 2002 | 71.62600 | 24501530 | 19014.5412 |
| 1320 | Saudi Arabia          | Asia   | 2007 | 72.77700 | 27601038 | 21654.8319 |
| 1321 | Senegal               | Africa | 1952 | 37.27800 | 2755589  | 1450.3570  |
| 1322 | Senegal               | Africa | 1957 | 39.32900 | 3054547  | 1567.6530  |
| 1323 | Senegal               | Africa | 1962 | 41.45400 | 3430243  | 1654.9887  |
| 1324 | Senegal               | Africa | 1967 | 43.56300 | 3965841  | 1612.4046  |
| 1325 | Senegal               | Africa | 1972 | 45.81500 | 4588696  | 1597.7121  |
| 1326 | Senegal               | Africa | 1977 | 48.87900 | 5260855  | 1561.7691  |
| 1327 | Senegal               | Africa | 1982 | 52.37900 | 6147783  | 1518.4800  |
| 1328 | Senegal               | Africa | 1987 | 55.76900 | 7171347  | 1441.7207  |
| 1329 | Senegal               | Africa | 1992 | 58.19600 | 8307920  | 1367.8994  |
| 1330 | Senegal               | Africa | 1997 | 60.18700 | 9535314  | 1392.3683  |
| 1331 | Senegal               | Africa | 2002 | 61.60000 | 10870037 | 1519.6353  |
| 1332 | Senegal               | Africa | 2007 | 63.06200 | 12267493 | 1712.4721  |
| 1333 | Serbia                | Europe | 1952 | 57.99600 | 6860147  | 3581.4594  |
| 1334 | Serbia                | Europe | 1957 | 61.68500 | 7271135  | 4981.0909  |
| 1335 | Serbia                | Europe | 1962 | 64.53100 | 7616060  | 6289.6292  |
| 1336 | Serbia                | Europe | 1967 | 66.91400 | 7971222  | 7991.7071  |

|      |                 |        |      |          |          |            |
|------|-----------------|--------|------|----------|----------|------------|
| 1337 | Serbia          | Europe | 1972 | 68.70000 | 8313288  | 10522.0675 |
| 1338 | Serbia          | Europe | 1977 | 70.30000 | 8686367  | 12980.6696 |
| 1339 | Serbia          | Europe | 1982 | 70.16200 | 9032824  | 15181.0927 |
| 1340 | Serbia          | Europe | 1987 | 71.21800 | 9230783  | 15870.8785 |
| 1341 | Serbia          | Europe | 1992 | 71.65900 | 9826397  | 9325.0682  |
| 1342 | Serbia          | Europe | 1997 | 72.23200 | 10336594 | 7914.3203  |
| 1343 | Serbia          | Europe | 2002 | 73.21300 | 10111559 | 7236.0753  |
| 1344 | Serbia          | Europe | 2007 | 74.00200 | 10150265 | 9786.5347  |
| 1345 | Sierra Leone    | Africa | 1952 | 30.33100 | 2143249  | 879.7877   |
| 1346 | Sierra Leone    | Africa | 1957 | 31.57000 | 2295678  | 1004.4844  |
| 1347 | Sierra Leone    | Africa | 1962 | 32.76700 | 2467895  | 1116.6399  |
| 1348 | Sierra Leone    | Africa | 1967 | 34.11300 | 2662190  | 1206.0435  |
| 1349 | Sierra Leone    | Africa | 1972 | 35.40000 | 2879013  | 1353.7598  |
| 1350 | Sierra Leone    | Africa | 1977 | 36.78800 | 3140897  | 1348.2852  |
| 1351 | Sierra Leone    | Africa | 1982 | 38.44500 | 3464522  | 1465.0108  |
| 1352 | Sierra Leone    | Africa | 1987 | 40.00600 | 3868905  | 1294.4478  |
| 1353 | Sierra Leone    | Africa | 1992 | 38.33300 | 4260884  | 1068.6963  |
| 1354 | Sierra Leone    | Africa | 1997 | 39.89700 | 4578212  | 574.6482   |
| 1355 | Sierra Leone    | Africa | 2002 | 41.01200 | 5359092  | 699.4897   |
| 1356 | Sierra Leone    | Africa | 2007 | 42.56800 | 6144562  | 862.5408   |
| 1357 | Singapore       | Asia   | 1952 | 60.39600 | 1127000  | 2315.1382  |
| 1358 | Singapore       | Asia   | 1957 | 63.17900 | 1445929  | 2843.1044  |
| 1359 | Singapore       | Asia   | 1962 | 65.79800 | 1750200  | 3674.7356  |
| 1360 | Singapore       | Asia   | 1967 | 67.94600 | 1977600  | 4977.4185  |
| 1361 | Singapore       | Asia   | 1972 | 69.52100 | 2152400  | 8597.7562  |
| 1362 | Singapore       | Asia   | 1977 | 70.79500 | 2325300  | 11210.0895 |
| 1363 | Singapore       | Asia   | 1982 | 71.76000 | 2651869  | 15169.1611 |
| 1364 | Singapore       | Asia   | 1987 | 73.56000 | 2794552  | 18861.5308 |
| 1365 | Singapore       | Asia   | 1992 | 75.78800 | 3235865  | 24769.8912 |
| 1366 | Singapore       | Asia   | 1997 | 77.15800 | 3802309  | 33519.4766 |
| 1367 | Singapore       | Asia   | 2002 | 78.77000 | 4197776  | 36023.1054 |
| 1368 | Singapore       | Asia   | 2007 | 79.97200 | 4553009  | 47143.1796 |
| 1369 | Slovak Republic | Europe | 1952 | 64.36000 | 3558137  | 5074.6591  |
| 1370 | Slovak Republic | Europe | 1957 | 67.45000 | 3844277  | 6093.2630  |
| 1371 | Slovak Republic | Europe | 1962 | 70.33000 | 4237384  | 7481.1076  |
| 1372 | Slovak Republic | Europe | 1967 | 70.98000 | 4442238  | 8412.9024  |
| 1373 | Slovak Republic | Europe | 1972 | 70.35000 | 4593433  | 9674.1676  |
| 1374 | Slovak Republic | Europe | 1977 | 70.45000 | 4827803  | 10922.6640 |
| 1375 | Slovak Republic | Europe | 1982 | 70.80000 | 5048043  | 11348.5459 |
| 1376 | Slovak Republic | Europe | 1987 | 71.08000 | 5199318  | 12037.2676 |
| 1377 | Slovak Republic | Europe | 1992 | 71.38000 | 5302888  | 9498.4677  |
| 1378 | Slovak Republic | Europe | 1997 | 72.71000 | 5383010  | 12126.2306 |
| 1379 | Slovak Republic | Europe | 2002 | 73.80000 | 5410052  | 13638.7784 |

|      |                 |        |      |          |          |            |
|------|-----------------|--------|------|----------|----------|------------|
| 1380 | Slovak Republic | Europe | 2007 | 74.66300 | 5447502  | 18678.3144 |
| 1381 | Slovenia        | Europe | 1952 | 65.57000 | 1489518  | 4215.0417  |
| 1382 | Slovenia        | Europe | 1957 | 67.85000 | 1533070  | 5862.2766  |
| 1383 | Slovenia        | Europe | 1962 | 69.15000 | 1582962  | 7402.3034  |
| 1384 | Slovenia        | Europe | 1967 | 69.18000 | 1646912  | 9405.4894  |
| 1385 | Slovenia        | Europe | 1972 | 69.82000 | 1694510  | 12383.4862 |
| 1386 | Slovenia        | Europe | 1977 | 70.97000 | 1746919  | 15277.0302 |
| 1387 | Slovenia        | Europe | 1982 | 71.06300 | 1861252  | 17866.7218 |
| 1388 | Slovenia        | Europe | 1987 | 72.25000 | 1945870  | 18678.5349 |
| 1389 | Slovenia        | Europe | 1992 | 73.64000 | 1999210  | 14214.7168 |
| 1390 | Slovenia        | Europe | 1997 | 75.13000 | 2011612  | 17161.1073 |
| 1391 | Slovenia        | Europe | 2002 | 76.66000 | 2011497  | 20660.0194 |
| 1392 | Slovenia        | Europe | 2007 | 77.92600 | 2009245  | 25768.2576 |
| 1393 | Somalia         | Africa | 1952 | 32.97800 | 2526994  | 1135.7498  |
| 1394 | Somalia         | Africa | 1957 | 34.97700 | 2780415  | 1258.1474  |
| 1395 | Somalia         | Africa | 1962 | 36.98100 | 3080153  | 1369.4883  |
| 1396 | Somalia         | Africa | 1967 | 38.97700 | 3428839  | 1284.7332  |
| 1397 | Somalia         | Africa | 1972 | 40.97300 | 3840161  | 1254.5761  |
| 1398 | Somalia         | Africa | 1977 | 41.97400 | 4353666  | 1450.9925  |
| 1399 | Somalia         | Africa | 1982 | 42.95500 | 5828892  | 1176.8070  |
| 1400 | Somalia         | Africa | 1987 | 44.50100 | 6921858  | 1093.2450  |
| 1401 | Somalia         | Africa | 1992 | 39.65800 | 6099799  | 926.9603   |
| 1402 | Somalia         | Africa | 1997 | 43.79500 | 6633514  | 930.5964   |
| 1403 | Somalia         | Africa | 2002 | 45.93600 | 7753310  | 882.0818   |
| 1404 | Somalia         | Africa | 2007 | 48.15900 | 9118773  | 926.1411   |
| 1405 | South Africa    | Africa | 1952 | 45.00900 | 14264935 | 4725.2955  |
| 1406 | South Africa    | Africa | 1957 | 47.98500 | 16151549 | 5487.1042  |
| 1407 | South Africa    | Africa | 1962 | 49.95100 | 18356657 | 5768.7297  |
| 1408 | South Africa    | Africa | 1967 | 51.92700 | 20997321 | 7114.4780  |
| 1409 | South Africa    | Africa | 1972 | 53.69600 | 23935810 | 7765.9626  |
| 1410 | South Africa    | Africa | 1977 | 55.52700 | 27129932 | 8028.6514  |
| 1411 | South Africa    | Africa | 1982 | 58.16100 | 31140029 | 8568.2662  |
| 1412 | South Africa    | Africa | 1987 | 60.83400 | 35933379 | 7825.8234  |
| 1413 | South Africa    | Africa | 1992 | 61.88800 | 39964159 | 7225.0693  |
| 1414 | South Africa    | Africa | 1997 | 60.23600 | 42835005 | 7479.1882  |
| 1415 | South Africa    | Africa | 2002 | 53.36500 | 44433622 | 7710.9464  |
| 1416 | South Africa    | Africa | 2007 | 49.33900 | 43997828 | 9269.6578  |
| 1417 | Spain           | Europe | 1952 | 64.94000 | 28549870 | 3834.0347  |
| 1418 | Spain           | Europe | 1957 | 66.66000 | 29841614 | 4564.8024  |
| 1419 | Spain           | Europe | 1962 | 69.69000 | 31158061 | 5693.8439  |
| 1420 | Spain           | Europe | 1967 | 71.44000 | 32850275 | 7993.5123  |
| 1421 | Spain           | Europe | 1972 | 73.06000 | 34513161 | 10638.7513 |
| 1422 | Spain           | Europe | 1977 | 74.39000 | 36439000 | 13236.9212 |

|      |           |        |      |          |          |            |
|------|-----------|--------|------|----------|----------|------------|
| 1423 | Spain     | Europe | 1982 | 76.30000 | 37983310 | 13926.1700 |
| 1424 | Spain     | Europe | 1987 | 76.90000 | 38880702 | 15764.9831 |
| 1425 | Spain     | Europe | 1992 | 77.57000 | 39549438 | 18603.0645 |
| 1426 | Spain     | Europe | 1997 | 78.77000 | 39855442 | 20445.2990 |
| 1427 | Spain     | Europe | 2002 | 79.78000 | 40152517 | 24835.4717 |
| 1428 | Spain     | Europe | 2007 | 80.94100 | 40448191 | 28821.0637 |
| 1429 | Sri Lanka | Asia   | 1952 | 57.59300 | 7982342  | 1083.5320  |
| 1430 | Sri Lanka | Asia   | 1957 | 61.45600 | 9128546  | 1072.5466  |
| 1431 | Sri Lanka | Asia   | 1962 | 62.19200 | 10421936 | 1074.4720  |
| 1432 | Sri Lanka | Asia   | 1967 | 64.26600 | 11737396 | 1135.5143  |
| 1433 | Sri Lanka | Asia   | 1972 | 65.04200 | 13016733 | 1213.3955  |
| 1434 | Sri Lanka | Asia   | 1977 | 65.94900 | 14116836 | 1348.7757  |
| 1435 | Sri Lanka | Asia   | 1982 | 68.75700 | 15410151 | 1648.0798  |
| 1436 | Sri Lanka | Asia   | 1987 | 69.01100 | 16495304 | 1876.7668  |
| 1437 | Sri Lanka | Asia   | 1992 | 70.37900 | 17587060 | 2153.7392  |
| 1438 | Sri Lanka | Asia   | 1997 | 70.45700 | 18698655 | 2664.4773  |
| 1439 | Sri Lanka | Asia   | 2002 | 70.81500 | 19576783 | 3015.3788  |
| 1440 | Sri Lanka | Asia   | 2007 | 72.39600 | 20378239 | 3970.0954  |
| 1441 | Sudan     | Africa | 1952 | 38.63500 | 8504667  | 1615.9911  |
| 1442 | Sudan     | Africa | 1957 | 39.62400 | 9753392  | 1770.3371  |
| 1443 | Sudan     | Africa | 1962 | 40.87000 | 11183227 | 1959.5938  |
| 1444 | Sudan     | Africa | 1967 | 42.85800 | 12716129 | 1687.9976  |
| 1445 | Sudan     | Africa | 1972 | 45.08300 | 14597019 | 1659.6528  |
| 1446 | Sudan     | Africa | 1977 | 47.80000 | 17104986 | 2202.9884  |
| 1447 | Sudan     | Africa | 1982 | 50.33800 | 20367053 | 1895.5441  |
| 1448 | Sudan     | Africa | 1987 | 51.74400 | 24725960 | 1507.8192  |
| 1449 | Sudan     | Africa | 1992 | 53.55600 | 28227588 | 1492.1970  |
| 1450 | Sudan     | Africa | 1997 | 55.37300 | 32160729 | 1632.2108  |
| 1451 | Sudan     | Africa | 2002 | 56.36900 | 37090298 | 1993.3983  |
| 1452 | Sudan     | Africa | 2007 | 58.55600 | 42292929 | 2602.3950  |
| 1453 | Swaziland | Africa | 1952 | 41.40700 | 290243   | 1148.3766  |
| 1454 | Swaziland | Africa | 1957 | 43.42400 | 326741   | 1244.7084  |
| 1455 | Swaziland | Africa | 1962 | 44.99200 | 370006   | 1856.1821  |
| 1456 | Swaziland | Africa | 1967 | 46.63300 | 420690   | 2613.1017  |
| 1457 | Swaziland | Africa | 1972 | 49.55200 | 480105   | 3364.8366  |
| 1458 | Swaziland | Africa | 1977 | 52.53700 | 551425   | 3781.4106  |
| 1459 | Swaziland | Africa | 1982 | 55.56100 | 649901   | 3895.3840  |
| 1460 | Swaziland | Africa | 1987 | 57.67800 | 779348   | 3984.8398  |
| 1461 | Swaziland | Africa | 1992 | 58.47400 | 962344   | 3553.0224  |
| 1462 | Swaziland | Africa | 1997 | 54.28900 | 1054486  | 3876.7685  |
| 1463 | Swaziland | Africa | 2002 | 43.86900 | 1130269  | 4128.1169  |
| 1464 | Swaziland | Africa | 2007 | 39.61300 | 1133066  | 4513.4806  |
| 1465 | Sweden    | Europe | 1952 | 71.86000 | 7124673  | 8527.8447  |

|      |             |        |      |          |          |            |
|------|-------------|--------|------|----------|----------|------------|
| 1466 | Sweden      | Europe | 1957 | 72.49000 | 7363802  | 9911.8782  |
| 1467 | Sweden      | Europe | 1962 | 73.37000 | 7561588  | 12329.4419 |
| 1468 | Sweden      | Europe | 1967 | 74.16000 | 7867931  | 15258.2970 |
| 1469 | Sweden      | Europe | 1972 | 74.72000 | 8122293  | 17832.0246 |
| 1470 | Sweden      | Europe | 1977 | 75.44000 | 8251648  | 18855.7252 |
| 1471 | Sweden      | Europe | 1982 | 76.42000 | 8325260  | 20667.3812 |
| 1472 | Sweden      | Europe | 1987 | 77.19000 | 8421403  | 23586.9293 |
| 1473 | Sweden      | Europe | 1992 | 78.16000 | 8718867  | 23880.0168 |
| 1474 | Sweden      | Europe | 1997 | 79.39000 | 8897619  | 25266.5950 |
| 1475 | Sweden      | Europe | 2002 | 80.04000 | 8954175  | 29341.6309 |
| 1476 | Sweden      | Europe | 2007 | 80.88400 | 9031088  | 33859.7484 |
| 1477 | Switzerland | Europe | 1952 | 69.62000 | 4815000  | 14734.2327 |
| 1478 | Switzerland | Europe | 1957 | 70.56000 | 5126000  | 17909.4897 |
| 1479 | Switzerland | Europe | 1962 | 71.32000 | 5666000  | 20431.0927 |
| 1480 | Switzerland | Europe | 1967 | 72.77000 | 6063000  | 22966.1443 |
| 1481 | Switzerland | Europe | 1972 | 73.78000 | 6401400  | 27195.1130 |
| 1482 | Switzerland | Europe | 1977 | 75.39000 | 6316424  | 26982.2905 |
| 1483 | Switzerland | Europe | 1982 | 76.21000 | 6468126  | 28397.7151 |
| 1484 | Switzerland | Europe | 1987 | 77.41000 | 6649942  | 30281.7046 |
| 1485 | Switzerland | Europe | 1992 | 78.03000 | 6995447  | 31871.5303 |
| 1486 | Switzerland | Europe | 1997 | 79.37000 | 7193761  | 32135.3230 |
| 1487 | Switzerland | Europe | 2002 | 80.62000 | 7361757  | 34480.9577 |
| 1488 | Switzerland | Europe | 2007 | 81.70100 | 7554661  | 37506.4191 |
| 1489 | Syria       | Asia   | 1952 | 45.88300 | 3661549  | 1643.4854  |
| 1490 | Syria       | Asia   | 1957 | 48.28400 | 4149908  | 2117.2349  |
| 1491 | Syria       | Asia   | 1962 | 50.30500 | 4834621  | 2193.0371  |
| 1492 | Syria       | Asia   | 1967 | 53.65500 | 5680812  | 1881.9236  |
| 1493 | Syria       | Asia   | 1972 | 57.29600 | 6701172  | 2571.4230  |
| 1494 | Syria       | Asia   | 1977 | 61.19500 | 7932503  | 3195.4846  |
| 1495 | Syria       | Asia   | 1982 | 64.59000 | 9410494  | 3761.8377  |
| 1496 | Syria       | Asia   | 1987 | 66.97400 | 11242847 | 3116.7743  |
| 1497 | Syria       | Asia   | 1992 | 69.24900 | 13219062 | 3340.5428  |
| 1498 | Syria       | Asia   | 1997 | 71.52700 | 15081016 | 4014.2390  |
| 1499 | Syria       | Asia   | 2002 | 73.05300 | 17155814 | 4090.9253  |
| 1500 | Syria       | Asia   | 2007 | 74.14300 | 19314747 | 4184.5481  |
| 1501 | Taiwan      | Asia   | 1952 | 58.50000 | 8550362  | 1206.9479  |
| 1502 | Taiwan      | Asia   | 1957 | 62.40000 | 10164215 | 1507.8613  |
| 1503 | Taiwan      | Asia   | 1962 | 65.20000 | 11918938 | 1822.8790  |
| 1504 | Taiwan      | Asia   | 1967 | 67.50000 | 13648692 | 2643.8587  |
| 1505 | Taiwan      | Asia   | 1972 | 69.39000 | 15226039 | 4062.5239  |
| 1506 | Taiwan      | Asia   | 1977 | 70.59000 | 16785196 | 5596.5198  |
| 1507 | Taiwan      | Asia   | 1982 | 72.16000 | 18501390 | 7426.3548  |
| 1508 | Taiwan      | Asia   | 1987 | 73.40000 | 19757799 | 11054.5618 |

|      |                     |          |      |          |          |            |
|------|---------------------|----------|------|----------|----------|------------|
| 1509 | Taiwan              | Asia     | 1992 | 74.26000 | 20686918 | 15215.6579 |
| 1510 | Taiwan              | Asia     | 1997 | 75.25000 | 21628605 | 20206.8210 |
| 1511 | Taiwan              | Asia     | 2002 | 76.99000 | 22454239 | 23235.4233 |
| 1512 | Taiwan              | Asia     | 2007 | 78.40000 | 23174294 | 28718.2768 |
| 1513 | Tanzania            | Africa   | 1952 | 41.21500 | 8322925  | 716.6501   |
| 1514 | Tanzania            | Africa   | 1957 | 42.97400 | 9452826  | 698.5356   |
| 1515 | Tanzania            | Africa   | 1962 | 44.24600 | 10863958 | 722.0038   |
| 1516 | Tanzania            | Africa   | 1967 | 45.75700 | 12607312 | 848.2187   |
| 1517 | Tanzania            | Africa   | 1972 | 47.62000 | 14706593 | 915.9851   |
| 1518 | Tanzania            | Africa   | 1977 | 49.91900 | 17129565 | 962.4923   |
| 1519 | Tanzania            | Africa   | 1982 | 50.60800 | 19844382 | 874.2426   |
| 1520 | Tanzania            | Africa   | 1987 | 51.53500 | 23040630 | 831.8221   |
| 1521 | Tanzania            | Africa   | 1992 | 50.44000 | 26605473 | 825.6825   |
| 1522 | Tanzania            | Africa   | 1997 | 48.46600 | 30686889 | 789.1862   |
| 1523 | Tanzania            | Africa   | 2002 | 49.65100 | 34593779 | 899.0742   |
| 1524 | Tanzania            | Africa   | 2007 | 52.51700 | 38139640 | 1107.4822  |
| 1525 | Thailand            | Asia     | 1952 | 50.84800 | 21289402 | 757.7974   |
| 1526 | Thailand            | Asia     | 1957 | 53.63000 | 25041917 | 793.5774   |
| 1527 | Thailand            | Asia     | 1962 | 56.06100 | 29263397 | 1002.1992  |
| 1528 | Thailand            | Asia     | 1967 | 58.28500 | 34024249 | 1295.4607  |
| 1529 | Thailand            | Asia     | 1972 | 60.40500 | 39276153 | 1524.3589  |
| 1530 | Thailand            | Asia     | 1977 | 62.49400 | 44148285 | 1961.2246  |
| 1531 | Thailand            | Asia     | 1982 | 64.59700 | 48827160 | 2393.2198  |
| 1532 | Thailand            | Asia     | 1987 | 66.08400 | 52910342 | 2982.6538  |
| 1533 | Thailand            | Asia     | 1992 | 67.29800 | 56667095 | 4616.8965  |
| 1534 | Thailand            | Asia     | 1997 | 67.52100 | 60216677 | 5852.6255  |
| 1535 | Thailand            | Asia     | 2002 | 68.56400 | 62806748 | 5913.1875  |
| 1536 | Thailand            | Asia     | 2007 | 70.61600 | 65068149 | 7458.3963  |
| 1537 | Togo                | Africa   | 1952 | 38.59600 | 1219113  | 859.8087   |
| 1538 | Togo                | Africa   | 1957 | 41.20800 | 1357445  | 925.9083   |
| 1539 | Togo                | Africa   | 1962 | 43.92200 | 1528098  | 1067.5348  |
| 1540 | Togo                | Africa   | 1967 | 46.76900 | 1735550  | 1477.5968  |
| 1541 | Togo                | Africa   | 1972 | 49.75900 | 2056351  | 1649.6602  |
| 1542 | Togo                | Africa   | 1977 | 52.88700 | 2308582  | 1532.7770  |
| 1543 | Togo                | Africa   | 1982 | 55.47100 | 2644765  | 1344.5780  |
| 1544 | Togo                | Africa   | 1987 | 56.94100 | 3154264  | 1202.2014  |
| 1545 | Togo                | Africa   | 1992 | 58.06100 | 3747553  | 1034.2989  |
| 1546 | Togo                | Africa   | 1997 | 58.39000 | 4320890  | 982.2869   |
| 1547 | Togo                | Africa   | 2002 | 57.56100 | 4977378  | 886.2206   |
| 1548 | Togo                | Africa   | 2007 | 58.42000 | 5701579  | 882.9699   |
| 1549 | Trinidad and Tobago | Americas | 1952 | 59.10000 | 662850   | 3023.2719  |
| 1550 | Trinidad and Tobago | Americas | 1957 | 61.80000 | 764900   | 4100.3934  |
| 1551 | Trinidad and Tobago | Americas | 1962 | 64.90000 | 887498   | 4997.5240  |

|      |                     |          |      |          |          |            |
|------|---------------------|----------|------|----------|----------|------------|
| 1552 | Trinidad and Tobago | Americas | 1967 | 65.40000 | 960155   | 5621.3685  |
| 1553 | Trinidad and Tobago | Americas | 1972 | 65.90000 | 975199   | 6619.5514  |
| 1554 | Trinidad and Tobago | Americas | 1977 | 68.30000 | 1039009  | 7899.5542  |
| 1555 | Trinidad and Tobago | Americas | 1982 | 68.83200 | 1116479  | 9119.5286  |
| 1556 | Trinidad and Tobago | Americas | 1987 | 69.58200 | 1191336  | 7388.5978  |
| 1557 | Trinidad and Tobago | Americas | 1992 | 69.86200 | 1183669  | 7370.9909  |
| 1558 | Trinidad and Tobago | Americas | 1997 | 69.46500 | 1138101  | 8792.5731  |
| 1559 | Trinidad and Tobago | Americas | 2002 | 68.97600 | 1101832  | 11460.6002 |
| 1560 | Trinidad and Tobago | Americas | 2007 | 69.81900 | 1056608  | 18008.5092 |
| 1561 | Tunisia             | Africa   | 1952 | 44.60000 | 3647735  | 1468.4756  |
| 1562 | Tunisia             | Africa   | 1957 | 47.10000 | 3950849  | 1395.2325  |
| 1563 | Tunisia             | Africa   | 1962 | 49.57900 | 4286552  | 1660.3032  |
| 1564 | Tunisia             | Africa   | 1967 | 52.05300 | 4786986  | 1932.3602  |
| 1565 | Tunisia             | Africa   | 1972 | 55.60200 | 5303507  | 2753.2860  |
| 1566 | Tunisia             | Africa   | 1977 | 59.83700 | 6005061  | 3120.8768  |
| 1567 | Tunisia             | Africa   | 1982 | 64.04800 | 6734098  | 3560.2332  |
| 1568 | Tunisia             | Africa   | 1987 | 66.89400 | 7724976  | 3810.4193  |
| 1569 | Tunisia             | Africa   | 1992 | 70.00100 | 8523077  | 4332.7202  |
| 1570 | Tunisia             | Africa   | 1997 | 71.97300 | 9231669  | 4876.7986  |
| 1571 | Tunisia             | Africa   | 2002 | 73.04200 | 9770575  | 5722.8957  |
| 1572 | Tunisia             | Africa   | 2007 | 73.92300 | 10276158 | 7092.9230  |
| 1573 | Turkey              | Europe   | 1952 | 43.58500 | 22235677 | 1969.1010  |
| 1574 | Turkey              | Europe   | 1957 | 48.07900 | 25670939 | 2218.7543  |
| 1575 | Turkey              | Europe   | 1962 | 52.09800 | 29788695 | 2322.8699  |
| 1576 | Turkey              | Europe   | 1967 | 54.33600 | 33411317 | 2826.3564  |
| 1577 | Turkey              | Europe   | 1972 | 57.00500 | 37492953 | 3450.6964  |
| 1578 | Turkey              | Europe   | 1977 | 59.50700 | 42404033 | 4269.1223  |
| 1579 | Turkey              | Europe   | 1982 | 61.03600 | 47328791 | 4241.3563  |
| 1580 | Turkey              | Europe   | 1987 | 63.10800 | 52881328 | 5089.0437  |
| 1581 | Turkey              | Europe   | 1992 | 66.14600 | 58179144 | 5678.3483  |
| 1582 | Turkey              | Europe   | 1997 | 68.83500 | 63047647 | 6601.4299  |
| 1583 | Turkey              | Europe   | 2002 | 70.84500 | 67308928 | 6508.0857  |
| 1584 | Turkey              | Europe   | 2007 | 71.77700 | 71158647 | 8458.2764  |
| 1585 | Uganda              | Africa   | 1952 | 39.97800 | 5824797  | 734.7535   |
| 1586 | Uganda              | Africa   | 1957 | 42.57100 | 6675501  | 774.3711   |
| 1587 | Uganda              | Africa   | 1962 | 45.34400 | 7688797  | 767.2717   |
| 1588 | Uganda              | Africa   | 1967 | 48.05100 | 8900294  | 908.9185   |
| 1589 | Uganda              | Africa   | 1972 | 51.01600 | 10190285 | 950.7359   |
| 1590 | Uganda              | Africa   | 1977 | 50.35000 | 11457758 | 843.7331   |
| 1591 | Uganda              | Africa   | 1982 | 49.84900 | 12939400 | 682.2662   |
| 1592 | Uganda              | Africa   | 1987 | 51.50900 | 15283050 | 617.7244   |
| 1593 | Uganda              | Africa   | 1992 | 48.82500 | 18252190 | 644.1708   |
| 1594 | Uganda              | Africa   | 1997 | 44.57800 | 21210254 | 816.5591   |

|      |                |          |      |          |           |            |
|------|----------------|----------|------|----------|-----------|------------|
| 1595 | Uganda         | Africa   | 2002 | 47.81300 | 24739869  | 927.7210   |
| 1596 | Uganda         | Africa   | 2007 | 51.54200 | 29170398  | 1056.3801  |
| 1597 | United Kingdom | Europe   | 1952 | 69.18000 | 50430000  | 9979.5085  |
| 1598 | United Kingdom | Europe   | 1957 | 70.42000 | 51430000  | 11283.1779 |
| 1599 | United Kingdom | Europe   | 1962 | 70.76000 | 53292000  | 12477.1771 |
| 1600 | United Kingdom | Europe   | 1967 | 71.36000 | 54959000  | 14142.8509 |
| 1601 | United Kingdom | Europe   | 1972 | 72.01000 | 56079000  | 15895.1164 |
| 1602 | United Kingdom | Europe   | 1977 | 72.76000 | 56179000  | 17428.7485 |
| 1603 | United Kingdom | Europe   | 1982 | 74.04000 | 56339704  | 18232.4245 |
| 1604 | United Kingdom | Europe   | 1987 | 75.00700 | 56981620  | 21664.7877 |
| 1605 | United Kingdom | Europe   | 1992 | 76.42000 | 57866349  | 22705.0925 |
| 1606 | United Kingdom | Europe   | 1997 | 77.21800 | 58808266  | 26074.5314 |
| 1607 | United Kingdom | Europe   | 2002 | 78.47100 | 59912431  | 29478.9992 |
| 1608 | United Kingdom | Europe   | 2007 | 79.42500 | 60776238  | 33203.2613 |
| 1609 | United States  | Americas | 1952 | 68.44000 | 157553000 | 13990.4821 |
| 1610 | United States  | Americas | 1957 | 69.49000 | 171984000 | 14847.1271 |
| 1611 | United States  | Americas | 1962 | 70.21000 | 186538000 | 16173.1459 |
| 1612 | United States  | Americas | 1967 | 70.76000 | 198712000 | 19530.3656 |
| 1613 | United States  | Americas | 1972 | 71.34000 | 209896000 | 21806.0359 |
| 1614 | United States  | Americas | 1977 | 73.38000 | 220239000 | 24072.6321 |
| 1615 | United States  | Americas | 1982 | 74.65000 | 232187835 | 25009.5591 |
| 1616 | United States  | Americas | 1987 | 75.02000 | 242803533 | 29884.3504 |
| 1617 | United States  | Americas | 1992 | 76.09000 | 256894189 | 32003.9322 |
| 1618 | United States  | Americas | 1997 | 76.81000 | 272911760 | 35767.4330 |
| 1619 | United States  | Americas | 2002 | 77.31000 | 287675526 | 39097.0995 |
| 1620 | United States  | Americas | 2007 | 78.24200 | 301139947 | 42951.6531 |
| 1621 | Uruguay        | Americas | 1952 | 66.07100 | 2252965   | 5716.7667  |
| 1622 | Uruguay        | Americas | 1957 | 67.04400 | 2424959   | 6150.7730  |
| 1623 | Uruguay        | Americas | 1962 | 68.25300 | 2598466   | 5603.3577  |
| 1624 | Uruguay        | Americas | 1967 | 68.46800 | 2748579   | 5444.6196  |
| 1625 | Uruguay        | Americas | 1972 | 68.67300 | 2829526   | 5703.4089  |
| 1626 | Uruguay        | Americas | 1977 | 69.48100 | 2873520   | 6504.3397  |
| 1627 | Uruguay        | Americas | 1982 | 70.80500 | 2953997   | 6920.2231  |
| 1628 | Uruguay        | Americas | 1987 | 71.91800 | 3045153   | 7452.3990  |
| 1629 | Uruguay        | Americas | 1992 | 72.75200 | 3149262   | 8137.0048  |
| 1630 | Uruguay        | Americas | 1997 | 74.22300 | 3262838   | 9230.2407  |
| 1631 | Uruguay        | Americas | 2002 | 75.30700 | 3363085   | 7727.0020  |
| 1632 | Uruguay        | Americas | 2007 | 76.38400 | 3447496   | 10611.4630 |
| 1633 | Venezuela      | Americas | 1952 | 55.08800 | 5439568   | 7689.7998  |
| 1634 | Venezuela      | Americas | 1957 | 57.90700 | 6702668   | 9802.4665  |
| 1635 | Venezuela      | Americas | 1962 | 60.77000 | 8143375   | 8422.9742  |
| 1636 | Venezuela      | Americas | 1967 | 63.47900 | 9709552   | 9541.4742  |
| 1637 | Venezuela      | Americas | 1972 | 65.71200 | 11515649  | 10505.2597 |

|      |                    |          |      |          |          |            |
|------|--------------------|----------|------|----------|----------|------------|
| 1638 | Venezuela          | Americas | 1977 | 67.45600 | 13503563 | 13143.9510 |
| 1639 | Venezuela          | Americas | 1982 | 68.55700 | 15620766 | 11152.4101 |
| 1640 | Venezuela          | Americas | 1987 | 70.19000 | 17910182 | 9883.5846  |
| 1641 | Venezuela          | Americas | 1992 | 71.15000 | 20265563 | 10733.9263 |
| 1642 | Venezuela          | Americas | 1997 | 72.14600 | 22374398 | 10165.4952 |
| 1643 | Venezuela          | Americas | 2002 | 72.76600 | 24287670 | 8605.0478  |
| 1644 | Venezuela          | Americas | 2007 | 73.74700 | 26084662 | 11415.8057 |
| 1645 | Vietnam            | Asia     | 1952 | 40.41200 | 26246839 | 605.0665   |
| 1646 | Vietnam            | Asia     | 1957 | 42.88700 | 28998543 | 676.2854   |
| 1647 | Vietnam            | Asia     | 1962 | 45.36300 | 33796140 | 772.0492   |
| 1648 | Vietnam            | Asia     | 1967 | 47.83800 | 39463910 | 637.1233   |
| 1649 | Vietnam            | Asia     | 1972 | 50.25400 | 44655014 | 699.5016   |
| 1650 | Vietnam            | Asia     | 1977 | 55.76400 | 50533506 | 713.5371   |
| 1651 | Vietnam            | Asia     | 1982 | 58.81600 | 56142181 | 707.2358   |
| 1652 | Vietnam            | Asia     | 1987 | 62.82000 | 62826491 | 820.7994   |
| 1653 | Vietnam            | Asia     | 1992 | 67.66200 | 69940728 | 989.0231   |
| 1654 | Vietnam            | Asia     | 1997 | 70.67200 | 76048996 | 1385.8968  |
| 1655 | Vietnam            | Asia     | 2002 | 73.01700 | 80908147 | 1764.4567  |
| 1656 | Vietnam            | Asia     | 2007 | 74.24900 | 85262356 | 2441.5764  |
| 1657 | West Bank and Gaza | Asia     | 1952 | 43.16000 | 1030585  | 1515.5923  |
| 1658 | West Bank and Gaza | Asia     | 1957 | 45.67100 | 1070439  | 1827.0677  |
| 1659 | West Bank and Gaza | Asia     | 1962 | 48.12700 | 1133134  | 2198.9563  |
| 1660 | West Bank and Gaza | Asia     | 1967 | 51.63100 | 1142636  | 2649.7150  |
| 1661 | West Bank and Gaza | Asia     | 1972 | 56.53200 | 1089572  | 3133.4093  |
| 1662 | West Bank and Gaza | Asia     | 1977 | 60.76500 | 1261091  | 3682.8315  |
| 1663 | West Bank and Gaza | Asia     | 1982 | 64.40600 | 1425876  | 4336.0321  |
| 1664 | West Bank and Gaza | Asia     | 1987 | 67.04600 | 1691210  | 5107.1974  |
| 1665 | West Bank and Gaza | Asia     | 1992 | 69.71800 | 2104779  | 6017.6548  |
| 1666 | West Bank and Gaza | Asia     | 1997 | 71.09600 | 2826046  | 7110.6676  |
| 1667 | West Bank and Gaza | Asia     | 2002 | 72.37000 | 3389578  | 4515.4876  |
| 1668 | West Bank and Gaza | Asia     | 2007 | 73.42200 | 4018332  | 3025.3498  |
| 1669 | Yemen, Rep.        | Asia     | 1952 | 32.54800 | 4963829  | 781.7176   |
| 1670 | Yemen, Rep.        | Asia     | 1957 | 33.97000 | 5498090  | 804.8305   |
| 1671 | Yemen, Rep.        | Asia     | 1962 | 35.18000 | 6120081  | 825.6232   |
| 1672 | Yemen, Rep.        | Asia     | 1967 | 36.98400 | 6740785  | 862.4421   |
| 1673 | Yemen, Rep.        | Asia     | 1972 | 39.84800 | 7407075  | 1265.0470  |
| 1674 | Yemen, Rep.        | Asia     | 1977 | 44.17500 | 8403990  | 1829.7652  |
| 1675 | Yemen, Rep.        | Asia     | 1982 | 49.11300 | 9657618  | 1977.5570  |
| 1676 | Yemen, Rep.        | Asia     | 1987 | 52.92200 | 11219340 | 1971.7415  |
| 1677 | Yemen, Rep.        | Asia     | 1992 | 55.59900 | 13367997 | 1879.4967  |
| 1678 | Yemen, Rep.        | Asia     | 1997 | 58.02000 | 15826497 | 2117.4845  |
| 1679 | Yemen, Rep.        | Asia     | 2002 | 60.30800 | 18701257 | 2234.8208  |
| 1680 | Yemen, Rep.        | Asia     | 2007 | 62.69800 | 22211743 | 2280.7699  |

|      |          |        |      |          |          |           |
|------|----------|--------|------|----------|----------|-----------|
| 1681 | Zambia   | Africa | 1952 | 42.03800 | 2672000  | 1147.3888 |
| 1682 | Zambia   | Africa | 1957 | 44.07700 | 3016000  | 1311.9568 |
| 1683 | Zambia   | Africa | 1962 | 46.02300 | 3421000  | 1452.7258 |
| 1684 | Zambia   | Africa | 1967 | 47.76800 | 3900000  | 1777.0773 |
| 1685 | Zambia   | Africa | 1972 | 50.10700 | 4506497  | 1773.4983 |
| 1686 | Zambia   | Africa | 1977 | 51.38600 | 5216550  | 1588.6883 |
| 1687 | Zambia   | Africa | 1982 | 51.82100 | 6100407  | 1408.6786 |
| 1688 | Zambia   | Africa | 1987 | 50.82100 | 7272406  | 1213.3151 |
| 1689 | Zambia   | Africa | 1992 | 46.10000 | 8381163  | 1210.8846 |
| 1690 | Zambia   | Africa | 1997 | 40.23800 | 9417789  | 1071.3538 |
| 1691 | Zambia   | Africa | 2002 | 39.19300 | 10595811 | 1071.6139 |
| 1692 | Zambia   | Africa | 2007 | 42.38400 | 11746035 | 1271.2116 |
| 1693 | Zimbabwe | Africa | 1952 | 48.45100 | 3080907  | 406.8841  |
| 1694 | Zimbabwe | Africa | 1957 | 50.46900 | 3646340  | 518.7643  |
| 1695 | Zimbabwe | Africa | 1962 | 52.35800 | 4277736  | 527.2722  |
| 1696 | Zimbabwe | Africa | 1967 | 53.99500 | 4995432  | 569.7951  |
| 1697 | Zimbabwe | Africa | 1972 | 55.63500 | 5861135  | 799.3622  |
| 1698 | Zimbabwe | Africa | 1977 | 57.67400 | 6642107  | 685.5877  |
| 1699 | Zimbabwe | Africa | 1982 | 60.36300 | 7636524  | 788.8550  |
| 1700 | Zimbabwe | Africa | 1987 | 62.35100 | 9216418  | 706.1573  |
| 1701 | Zimbabwe | Africa | 1992 | 60.37700 | 10704340 | 693.4208  |
| 1702 | Zimbabwe | Africa | 1997 | 46.80900 | 11404948 | 792.4500  |
| 1703 | Zimbabwe | Africa | 2002 | 39.98900 | 11926563 | 672.0386  |
| 1704 | Zimbabwe | Africa | 2007 | 43.48700 | 12311143 | 469.7093  |

Here are the main differences:

1. The version loaded using the base R `read.csv()` function prints out the first 1000 rows (though I've kindly put them all in a nice scrollly box for you), whereas the version loaded using the tidyverse `read_csv()` function only prints out the first 10 rows (and it also only displays the first few columns whenever your dataset contains a large number of columns).
2. The version loaded using the tidyverse `read_csv()` function will also show you what *type/class* each columns has. Look underneath the column names of the tidyverse `read_csv()` version of `gapminder` above. See the `<chr>` and `<dbl>` symbols? These mean “character” and “double” (“double” means “numeric with decimals”), respectively.
3. The tidyverse `read_csv()` version prints out some information at the top that says `# A tibble: 1,704 × 6`, which tells us that our data frame has 1,704 rows and 6 columns.

What's a “tibble”? It turns out that `read_csv()` doesn't actually load your data in as a data frame. It loads your data in as a “*tibble*”. While tibbles have some fancy features, for our purposes, you can just think of a tibble as a data frame that looks slightly different when

printed. Note that I will usually use the term “data frame” even if the object is technically a tibble.

## 6.3 The dplyr library

So we’ve now loaded the tidyverse library and we’ve loaded our gapminder data using `read_csv()`. The code we’ve written so far in this chapter is essentially just:

```
library(tidyverse)
gapminder <- read_csv("data/gapminder.csv")
```

When we loaded the “tidyverse” library, this also loaded the “dplyr” library (along with several others.)

The dplyr library is probably the most important library in the tidyverse. It contains a bunch of functions that allow you to work with data frames like extract columns, modify columns, and filter based on conditions.

The main dplyr functions to master are:

- `select()`: extract columns from your data frame
- `filter()`: filter to rows of your data frame based on a condition
- `mutate()`: add columns or modify columns in your data frame
- `summarize()`: aggregate information in your columns
- `group_by()`: perform an operation separately for each value of a categorical column

The rest of this chapter will guide you through using these functions step by step, showing not only how they work individually but also how to combine them. Once you’re comfortable with these functions, you’ll be ready to tackle a variety of data analysis tasks.

## 6.4 Select() for extracting columns

We can use the `select()` function to extract specific named columns from our data frame.

- The *first argument* of `select()` is always the data frame on which you are operating.
- All of the *remaining arguments* of `select()` are the names of the columns that you want to keep.

Note that the column names do *not* have quotes around them. This is something that makes dplyr (and tidyverse) functions special.

So if we want to use `select()` to extract just the `country`, `year`, and `lifeExp` columns from our `gapminder` data frame, the first argument will be the name of our data frame object, `gapminder`, and the subsequent arguments will be the names of the columns we want to extract:

```
select(gapminder, country, year, lifeExp)
```

```
# A tibble: 1,704 x 3
  country      year  lifeExp
  <chr>       <dbl>   <dbl>
1 Afghanistan 1952    28.8
2 Afghanistan 1957    30.3
3 Afghanistan 1962    32.0
4 Afghanistan 1967    34.0
5 Afghanistan 1972    36.1
6 Afghanistan 1977    38.4
7 Afghanistan 1982    39.9
8 Afghanistan 1987    40.8
9 Afghanistan 1992    41.7
10 Afghanistan 1997   41.8
# i 1,694 more rows
```

Note that I haven't *modified* the original `gapminder` data frame object here. If I print `gapminder`, it still has all of the original columns:

```
gapminder
```

```
# A tibble: 1,704 x 6
  country     continent  year  lifeExp      pop gdpPercap
  <chr>       <chr>     <dbl>   <dbl>     <dbl>      <dbl>
1 Afghanistan Asia      1952    28.8  8425333    779.
2 Afghanistan Asia      1957    30.3  9240934    821.
3 Afghanistan Asia      1962    32.0  10267083   853.
4 Afghanistan Asia      1967    34.0  11537966   836.
5 Afghanistan Asia      1972    36.1  13079460   740.
6 Afghanistan Asia      1977    38.4  14880372   786.
7 Afghanistan Asia      1982    39.9  12881816   978.
8 Afghanistan Asia      1987    40.8  13867957   852.
9 Afghanistan Asia      1992    41.7  16317921   649.
```

```
10 Afghanistan Asia      1997    41.8 22227415      635.  
# i 1,694 more rows
```

Instead, I have created a *new* data frame with just the `country`, `year`, and `lifeExp` columns, and I've just printed it out.

If I wanted to *use* this `country`, `year`, and `lifeExp` subsetted data frame, I would need to save it as a new variable/object using the `<-` assignment operator:

```
gapminder_subset <- select(gapminder, country, year, lifeExp)
```

And I could then work with this new data frame by referencing `gapminder_subset` in my code:

```
gapminder_subset
```

```
# A tibble: 1,704 x 3  
  country     year lifeExp  
  <chr>      <dbl>   <dbl>  
1 Afghanistan 1952    28.8  
2 Afghanistan 1957    30.3  
3 Afghanistan 1962    32.0  
4 Afghanistan 1967    34.0  
5 Afghanistan 1972    36.1  
6 Afghanistan 1977    38.4  
7 Afghanistan 1982    39.9  
8 Afghanistan 1987    40.8  
9 Afghanistan 1992    41.7  
10 Afghanistan 1997   41.8  
# i 1,694 more rows
```

In this chapter, however, I will typically print the output of various data frame operations without saving the resulting data frame output as new objects. This is because I just want to show what the result will be. I don't necessarily need to use the resulting data frames for anything (so there is no point in saving them as new objects).

#### 6.4.1 Removing columns with `select()`

You can remove columns by using a minus sign in front of the column name. For example, the following code will return the `gapminder` data frame *without* the `continent`, `year`, and `pop` columns:

```
select(gapminder, -continent, -year, -pop)

# A tibble: 1,704 x 3
  country    lifeExp gdpPercap
  <chr>      <dbl>     <dbl>
1 Afghanistan 28.8      779.
2 Afghanistan 30.3      821.
3 Afghanistan 32.0      853.
4 Afghanistan 34.0      836.
5 Afghanistan 36.1      740.
6 Afghanistan 38.4      786.
7 Afghanistan 39.9      978.
8 Afghanistan 40.8      852.
9 Afghanistan 41.7      649.
10 Afghanistan 41.8      635.
# i 1,694 more rows
```

#### 6.4.2 Renaming columns with `select()`

`select()` can also help you rename columns. If you provide a named argument for your columns as `new_name = old_name`, the resulting column in the output data frame will be renamed to whatever you provide as `new_name`. For example, the following code will return the `gapminder` data frame with the `country`, `year`, `lifeExp`, and `gdpPercap` columns, except the `lifeExp` column will be renamed to `life_exp` and the `gdpPercap` column renamed to `gdp_per_cap`:

```
select(gapminder, country, year, life_exp = lifeExp, gdp_per_cap = gdpPercap)

# A tibble: 1,704 x 4
  country    year life_exp gdp_per_cap
  <chr>      <dbl>     <dbl>     <dbl>
1 Afghanistan 1952     28.8      779.
2 Afghanistan 1957     30.3      821.
3 Afghanistan 1962     32.0      853.
4 Afghanistan 1967     34.0      836.
5 Afghanistan 1972     36.1      740.
6 Afghanistan 1977     38.4      786.
7 Afghanistan 1982     39.9      978.
8 Afghanistan 1987     40.8      852.
9 Afghanistan 1992     41.7      649.
```

```
10 Afghanistan 1997      41.8        635.  
# i 1,694 more rows
```

### 6.4.3 Renaming columns with `rename()`

However, `select()` will only return the columns included in its arguments. If you want to rename a column without also having to list all the other columns you want in your output data frame, you can use the `rename()` function instead.

For example, the following code will return *all columns* in the `gapminder` data frame, with the `lifeExp` column renamed to `life_exp` and the `gdpPercap` column renamed to `gdp_per_cap`:

```
rename(gapminder, life_exp = lifeExp, gdp_per_cap = gdpPercap)
```

```
# A tibble: 1,704 x 6  
  country   continent year life_exp     pop gdp_per_cap  
  <chr>     <chr>    <dbl>    <dbl>     <dbl>    <dbl>  
1 Afghanistan Asia      1952     28.8  8425333     779.  
2 Afghanistan Asia      1957     30.3  9240934     821.  
3 Afghanistan Asia      1962     32.0  10267083    853.  
4 Afghanistan Asia      1967     34.0  11537966    836.  
5 Afghanistan Asia      1972     36.1  13079460    740.  
6 Afghanistan Asia      1977     38.4  14880372    786.  
7 Afghanistan Asia      1982     39.9  12881816    978.  
8 Afghanistan Asia      1987     40.8  13867957    852.  
9 Afghanistan Asia      1992     41.7  16317921    649.  
10 Afghanistan Asia     1997     41.8  22227415    635.  
# i 1,694 more rows
```

## 6.5 Question

What would happen if I replaced `rename()` in the code above with `select()`? As in:

```
select(gapminder, life_exp = lifeExp, gdp_per_cap = gdpPercap)
```

## 6.6 Answer

The resulting data frame output would *only* include the `life_exp` and `gdp_per_cap` columns!

```
select(gapminder, life_exp = lifeExp, gdp_per_cap = gdpPercap)
```

```
# A tibble: 1,704 x 2
  life_exp gdp_per_cap
  <dbl>      <dbl>
1 28.8        779.
2 30.3        821.
3 32.0        853.
4 34.0        836.
5 36.1        740.
6 38.4        786.
7 39.9        978.
8 40.8        852.
9 41.7        649.
10 41.8       635.
# i 1,694 more rows
```

## 6.7 The pipe |> (formerly known as %>%)

Before introducing our next dplyr function, I want to introduce you to an operator called the **pipe**. The pipe is literally (in my very biased opinion) the best coding invention ever.

The pipe, `|>`, allows us to read our code as if it is a sentence. For example, if I wanted to turn the following sentence “*I take my backpack and then I put books in it and then put it on my back*” using the pipe, I would write `backpack |> put_books_in() |> put_on_back()`. I always think of the pipe operator `|>` as the word “and then” in a sentence.

Take a look at the following code:

```
gapminder |> select(country, year, lifeExp)
```

```
# A tibble: 1,704 x 3
  country      year lifeExp
  <chr>        <dbl>   <dbl>
1 Afghanistan 1952    28.8
2 Afghanistan 1957    30.3
```

```

3 Afghanistan 1962 32.0
4 Afghanistan 1967 34.0
5 Afghanistan 1972 36.1
6 Afghanistan 1977 38.4
7 Afghanistan 1982 39.9
8 Afghanistan 1987 40.8
9 Afghanistan 1992 41.7
10 Afghanistan 1997 41.8
# i 1,694 more rows

```

I read this code in my head as “*take the gapminder data frame and then select the country, year, and lifeExp columns*”:

The pipe syntax is: `object |> function()`. The way it works is that the object to the left of the pipe (`object`) is placed into the *first argument* of the function to the right of the pipe (`function()`).

This means that the following two pieces of code are equivalent:

```
# apply head() to gapminder directly
head(gapminder)
```

```
# A tibble: 6 x 6
  country   continent   year lifeExp      pop gdpPercap
  <chr>     <chr>     <dbl>   <dbl>     <dbl>     <dbl>
1 Afghanistan Asia     1952    28.8  8425333    779.
2 Afghanistan Asia     1957    30.3  9240934    821.
3 Afghanistan Asia     1962    32.0  10267083   853.
4 Afghanistan Asia     1967    34.0  11537966   836.
5 Afghanistan Asia     1972    36.1  13079460   740.
6 Afghanistan Asia     1977    38.4  14880372   786.
```

```
# apply head() to gapminder using the pipe
gapminder |> head()
```

```
# A tibble: 6 x 6
  country   continent   year lifeExp      pop gdpPercap
  <chr>     <chr>     <dbl>   <dbl>     <dbl>     <dbl>
1 Afghanistan Asia     1952    28.8  8425333    779.
2 Afghanistan Asia     1957    30.3  9240934    821.
3 Afghanistan Asia     1962    32.0  10267083   853.
4 Afghanistan Asia     1967    34.0  11537966   836.
```

|   |             |      |      |      |          |      |
|---|-------------|------|------|------|----------|------|
| 5 | Afghanistan | Asia | 1972 | 36.1 | 13079460 | 740. |
| 6 | Afghanistan | Asia | 1977 | 38.4 | 14880372 | 786. |

The second version with the pipe takes the `gapminder` data frame (which is to the left of the pipe) and places it into the (first) argument of the `head()` function on the right of the pipe. The pipe always has an object (like a data frame) on its left and a function on its right.

Here is another example of two pieces of equivalent code, first, without the pipe:

```
# without the pipe
select(gapminder, year, pop)
```

```
# A tibble: 1,704 x 2
  year     pop
  <dbl>   <dbl>
1 1952  8425333
2 1957  9240934
3 1962 10267083
4 1967 11537966
5 1972 13079460
6 1977 14880372
7 1982 12881816
8 1987 13867957
9 1992 16317921
10 1997 22227415
# i 1,694 more rows
```

Second, with the pipe (“take the `gapminder` data frame *and then* select the `year` and `pop` columns”):

```
# with the pipe
gapminder |> select(year, pop)
```

```
# A tibble: 1,704 x 2
  year     pop
  <dbl>   <dbl>
1 1952  8425333
2 1957  9240934
3 1962 10267083
4 1967 11537966
5 1972 13079460
```

```
6 1977 14880372
7 1982 12881816
8 1987 13867957
9 1992 16317921
10 1997 22227415
# i 1,694 more rows
```

Remember that the pipe places the object on the left of the pipe into the *first* argument of the function on the right of the pipe. The `select()` function, however, takes many arguments. If the function to the right of the pipe `|>` takes more than one argument, then the remaining arguments are just included inside the parentheses of the function on the right of the pipe.

#### The “new” pipe `|>` versus the “old” pipe `%>%`

The pipe `|>` is now a part of the “base R” programming language. Previously, you needed to load the “magrittr”, “dplyr”, or “tidyverse” libraries to access the pipe and it had a different symbol: `%>%`.

The two pipes behave very similarly. The main difference I noticed when I switched was that the old pipe didn’t require parentheses for functions that didn’t have any additional arguments, e.g., you could write `df %>% head`. But the new pipe requires the empty parentheses after the function, as in: `df |> head()`.

The old pipe `%>%` still works, but my recommendation is that you use the newer “native” pipe syntax: `|>`.

## 6.8 Filtering rows using `filter()`

Our next dplyr function, `filter()`, lets you filter to specific rows based on a logical condition.

Imagine that we just want to look at the rows in the `gapminder` data frame whose `country` value is "Australia". Then we can write:

```
filter(gapminder, country == "Australia")
```

```
# A tibble: 12 x 6
  country continent year lifeExp      pop gdpPercap
  <chr>     <chr>   <dbl>    <dbl>    <dbl>      <dbl>
1 Australia Oceania    1952     69.1  8691212    10040.
2 Australia Oceania    1957     70.3  9712569    10950.
3 Australia Oceania    1962     70.9 10794968    12217.
4 Australia Oceania    1967     71.1 11872264    14526.
```

|    |           |         |      |      |          |        |
|----|-----------|---------|------|------|----------|--------|
| 5  | Australia | Oceania | 1972 | 71.9 | 13177000 | 16789. |
| 6  | Australia | Oceania | 1977 | 73.5 | 14074100 | 18334. |
| 7  | Australia | Oceania | 1982 | 74.7 | 15184200 | 19477. |
| 8  | Australia | Oceania | 1987 | 76.3 | 16257249 | 21889. |
| 9  | Australia | Oceania | 1992 | 77.6 | 17481977 | 23425. |
| 10 | Australia | Oceania | 1997 | 78.8 | 18565243 | 26998. |
| 11 | Australia | Oceania | 2002 | 80.4 | 19546792 | 30688. |
| 12 | Australia | Oceania | 2007 | 81.2 | 20434176 | 34435. |

Where:

- The first argument of `filter()` is the data frame (`gapminder`) that you want to operate on.
- The second argument of `filter()` is the *logical condition* involving the column of the data frame that you want to use to filter (`country == "Australia"`).

`filter()` will return all rows for which the provided condition is TRUE. Note that in our condition, we do *not* need quotes around the column name, `country`, but we *do* need quotes around the value, "Australia". Remember that when asking a logical question of equality, we need to use two equal signs `==`.

Now that we have met our trusty pipe, we can rewrite this `filter()` code as:

```
gapminder |> filter(country == "Australia")
```

```
# A tibble: 12 x 6
  country continent year lifeExp      pop gdpPercap
  <chr>    <chr>   <dbl>   <dbl>     <dbl>     <dbl>
1 Australia Oceania  1952     69.1  8691212  10040.
2 Australia Oceania  1957     70.3  9712569  10950.
3 Australia Oceania  1962     70.9  10794968 12217.
4 Australia Oceania  1967     71.1  11872264 14526.
5 Australia Oceania  1972     71.9  13177000 16789.
6 Australia Oceania  1977     73.5  14074100 18334.
7 Australia Oceania  1982     74.7  15184200 19477.
8 Australia Oceania  1987     76.3  16257249 21889.
9 Australia Oceania  1992     77.6  17481977 23425.
10 Australia Oceania  1997     78.8  18565243 26998.
11 Australia Oceania  2002     80.4  19546792 30688.
12 Australia Oceania  2007     81.2  20434176 34435.
```

Remember that the pipe, `|>`, places the object on the left-hand side (`gapminder`) into the first argument of the function (`filter()`) on the right-hand side.

### 6.8.1 Multiple filtering conditions

You can provide multiple conditions to `filter()` as separate arguments. Given multiple conditions, `filter()` returns the rows for which *all* of the provided conditions are TRUE.

For example, the following code will filter the `gapminder` data frame to the rows where both `country == "Australia"` AND `year > 1990` are TRUE.

```
gapminder |> filter(country == "Australia", year > 1990)
```

```
# A tibble: 4 x 6
  country continent year lifeExp      pop gdpPercap
  <chr>     <chr>   <dbl>    <dbl>    <dbl>    <dbl>
1 Australia Oceania    1992     77.6 17481977    23425.
2 Australia Oceania    1997     78.8 18565243    26998.
3 Australia Oceania    2002     80.4 19546792    30688.
4 Australia Oceania    2007     81.2 20434176    34435.
```

Take note of when we do and when we do not need quotes. We never need quotes when referencing a column name from our data frame inside a dplyr function, nor do we need quotes for numeric values, such as 1990. We do, however, need quotes when referencing a *character* value, such as "Australia".

You can read this code (`gapminder |> filter(country == "Australia", year > 1990)`) as “take the gapminder data frame *and then* filter to the rows where the country is Australia and the year is greater than 1990”.

To start to get a sense of why the pipe is so useful, let’s use it to combine some sequential `filter()` and `select()` operations:

- Filter to the rows where the `continent` column is "Africa" and the `year` column is 1992.
- Select just the `country` and `lifeExp` columns (renaming `lifeExp` to `life_exp`).

```
gapminder |>
  filter(continent == "Africa", year == 1992) |>
  select(country, life_exp = lifeExp)
```

```
# A tibble: 52 x 2
  country           life_exp
  <chr>              <dbl>
1 Algeria            67.7
```

```

2 Angola          40.6
3 Benin           53.9
4 Botswana        62.7
5 Burkina Faso   50.3
6 Burundi          44.7
7 Cameroon         54.3
8 Central African Republic 49.4
9 Chad              51.7
10 Comoros         57.9
# i 42 more rows

```

Note that I like to start a new line *after* each pipe |> to make the code more readable.

How would you read the code above as a sentence? I read it as “take the gapminder dataset *and then* filter to just the rows where the continent column is equal to "Africa" and the year column is equal to 1992 *and then* select just the country and lifeExp columns, renaming lifeExp to be life\_exp”.

Since the output of just the first filtered part of the above code, gapminder |> filter(continent == "Africa", year == 1992), is a data frame itself, when I add another pipe |> after this first operation, I am piping the resulting filtered data frame into the subsequent select() function.

If I wanted to try to write this code *without* the pipe, I would have to do it in a few steps like this:

```
gapminder_africa_1992 <- filter(gapminder, continent == "Africa", year == 1992)
select(gapminder_africa_1992, country, life_exp = lifeExp)
```

```

# A tibble: 52 x 2
  country             life_exp
  <chr>                <dbl>
1 Algeria            67.7
2 Angola              40.6
3 Benin               53.9
4 Botswana            62.7
5 Burkina Faso       50.3
6 Burundi              44.7
7 Cameroon             54.3
8 Central African Republic 49.4
9 Chad                 51.7
10 Comoros            57.9
# i 42 more rows

```

This code does the same thing, but without the pipe, I am forced to define an intermediate object, `gapminder_africa_1992` (or do some disgusting nested function stuff), which feels inferior to the pipe-based approach. The pipe allows me to do all this in a single, more readable, and more efficient operation.

### 6.8.2 The order of operations

It turns out that the order of operations when conducting dplyr operations can be fairly important.

For example, if I swap the order of `select()` and `filter()` in the code above, I will get an error:

```
# swap the filter and select steps above
gapminder |>
  select(country, life_exp = lifeExp) |>
  filter(continent == "Africa", year == 1992)
```

```
Error in `filter()`:
i In argument: `continent == "Africa"`.
Caused by error:
! object 'continent' not found
```

Why do you think this happens? Take a look at the error message for a hint. R is telling us that there is no `continent` column. What data frame is being piped into the `filter()` function?

Let's run just the first two lines of code to find out:

```
gapminder |>
  select(country, life_exp = lifeExp)

# # A tibble: 1,704 x 2
#   country     life_exp
#   <chr>        <dbl>
# 1 Afghanistan  28.8
# 2 Afghanistan  30.3
# 3 Afghanistan  32.0
# 4 Afghanistan  34.0
# 5 Afghanistan  36.1
# 6 Afghanistan  38.4
```

```
7 Afghanistan    39.9
8 Afghanistan    40.8
9 Afghanistan    41.7
10 Afghanistan   41.8
# i 1,694 more rows
```

This is the data frame that is being piped into `filter()`. Does it contain a `continent` column? No, it does not! So the `filter()` function is trying to filter this two-column data frame to just the rows for which its `continent` column is equal to "Africa", but this two-column data frame doesn't contain a `continent` column!

The following two pieces of code are therefore *not* equivalent:

```
gapminder |>
  filter(continent == "Africa", year == 1992) |>
  select(country, life_exp = lifeExp)
```

```
gapminder |>
  select(country, life_exp = lifeExp) |>
  filter(continent == "Africa", year == 1992)
```

### 6.8.3 Filtering using “OR” conditions

How would you filter to the rows where country corresponds to "Australia" and "Italy"? You might imagine that you can provide these two conditions separated by a comma, as in:

```
gapminder |> filter(country == "Australia", country == "Italy")
```

```
# A tibble: 0 x 6
# i 6 variables: country <chr>, continent <chr>, year <dbl>, lifeExp <dbl>,
#   pop <dbl>, gdpPercap <dbl>
```

However, this has returned an *empty* data frame with 0 rows. Why has this happened?

Remember that whenever you provide two conditions to `filter()` with a comma, R filters to the rows where *both* conditions are true. That is, a comma corresponds to an "AND" condition.

`filter(country == "Australia", country == "Italy")` means "filter to the rows where `country == "Australia"` AND `country == "Italy"` are both true. However, there are no rows where `country` is simultaneously equal to "Australia" and "Italy". It is only ever equal to one or the other.

Although I phrased my desire as “filter to the rows where `country` corresponds to Australia **and** Italy”, I really meant, “filter to the rows `country` corresponds to Australia **or** Italy”.

Can you remember how to ask an “OR” question? You use the vertical bar `|`. So to provide an “OR” condition, I could provide my two conditions separated by a vertical bar, `(condition 1) | (condition 2)`, which will return all rows where *either* condition 1 *or* condition 2 are satisfied:

```
gapminder |>
  filter((country == "Australia") | (country == "Italy"))
```

```
# A tibble: 24 x 6
  country continent year lifeExp      pop gdpPercap
  <chr>    <chr>   <dbl>   <dbl>     <dbl>     <dbl>
1 Australia Oceania  1952     69.1  8691212    10040.
2 Australia Oceania  1957     70.3  9712569    10950.
3 Australia Oceania  1962     70.9  10794968   12217.
4 Australia Oceania  1967     71.1  11872264   14526.
5 Australia Oceania  1972     71.9  13177000   16789.
6 Australia Oceania  1977     73.5  14074100   18334.
7 Australia Oceania  1982     74.7  15184200   19477.
8 Australia Oceania  1987     76.3  16257249   21889.
9 Australia Oceania  1992     77.6  17481977   23425.
10 Australia Oceania 1997     78.8  18565243   26998.
# i 14 more rows
```

Here R is trying to be helpful by only printing the first 10 rows. I can tell it to print all 24 by piping my data frame into a `print()` function:

```
gapminder |>
  filter((country == "Australia") | (country == "Italy")) |>
  print(n = 24)
```

```
# A tibble: 24 x 6
  country continent year lifeExp      pop gdpPercap
  <chr>    <chr>   <dbl>   <dbl>     <dbl>     <dbl>
1 Australia Oceania  1952     69.1  8691212    10040.
2 Australia Oceania  1957     70.3  9712569    10950.
3 Australia Oceania  1962     70.9  10794968   12217.
4 Australia Oceania  1967     71.1  11872264   14526.
5 Australia Oceania  1972     71.9  13177000   16789.
```

|    |           |         |      |      |          |        |
|----|-----------|---------|------|------|----------|--------|
| 6  | Australia | Oceania | 1977 | 73.5 | 14074100 | 18334. |
| 7  | Australia | Oceania | 1982 | 74.7 | 15184200 | 19477. |
| 8  | Australia | Oceania | 1987 | 76.3 | 16257249 | 21889. |
| 9  | Australia | Oceania | 1992 | 77.6 | 17481977 | 23425. |
| 10 | Australia | Oceania | 1997 | 78.8 | 18565243 | 26998. |
| 11 | Australia | Oceania | 2002 | 80.4 | 19546792 | 30688. |
| 12 | Australia | Oceania | 2007 | 81.2 | 20434176 | 34435. |
| 13 | Italy     | Europe  | 1952 | 65.9 | 47666000 | 4931.  |
| 14 | Italy     | Europe  | 1957 | 67.8 | 49182000 | 6249.  |
| 15 | Italy     | Europe  | 1962 | 69.2 | 50843200 | 8244.  |
| 16 | Italy     | Europe  | 1967 | 71.1 | 52667100 | 10022. |
| 17 | Italy     | Europe  | 1972 | 72.2 | 54365564 | 12269. |
| 18 | Italy     | Europe  | 1977 | 73.5 | 56059245 | 14256. |
| 19 | Italy     | Europe  | 1982 | 75.0 | 56535636 | 16537. |
| 20 | Italy     | Europe  | 1987 | 76.4 | 56729703 | 19207. |
| 21 | Italy     | Europe  | 1992 | 77.4 | 56840847 | 22014. |
| 22 | Italy     | Europe  | 1997 | 78.8 | 57479469 | 24675. |
| 23 | Italy     | Europe  | 2002 | 80.2 | 57926999 | 27968. |
| 24 | Italy     | Europe  | 2007 | 80.5 | 58147733 | 28570. |

If both conditions involve the same variable (in this case, `country`), you can instead use the `%in%` operator! Remember that you can ask which values in a vector are also in some other vector, such as asking which values in the vector `c(1, 5, 2, 2, 1, 6)` are equal to 1 or 2 (i.e., are in the vector `c(1, 2)`) by writing:

```
c(1, 5, 2, 2, 1, 6) %in% c(1, 2)
```

```
[1] TRUE FALSE TRUE TRUE TRUE FALSE
```

We can use this same `%in%` operator to ask which entries of the `country` column are equal to "Australia" or "Italy":

```
gapminder |>
  filter(country %in% c("Australia", "Italy")) |>
  print(n = 24)
```

```
# A tibble: 24 x 6
  country continent year lifeExp      pop gdpPercap
  <chr>    <chr>   <dbl>    <dbl>    <dbl>    <dbl>
  1 Australia Oceania 1952     69.1  8691212    10040.
  2 Australia Oceania 1957     70.3  9712569    10950.
```

|    |           |         |      |      |          |        |
|----|-----------|---------|------|------|----------|--------|
| 3  | Australia | Oceania | 1962 | 70.9 | 10794968 | 12217. |
| 4  | Australia | Oceania | 1967 | 71.1 | 11872264 | 14526. |
| 5  | Australia | Oceania | 1972 | 71.9 | 13177000 | 16789. |
| 6  | Australia | Oceania | 1977 | 73.5 | 14074100 | 18334. |
| 7  | Australia | Oceania | 1982 | 74.7 | 15184200 | 19477. |
| 8  | Australia | Oceania | 1987 | 76.3 | 16257249 | 21889. |
| 9  | Australia | Oceania | 1992 | 77.6 | 17481977 | 23425. |
| 10 | Australia | Oceania | 1997 | 78.8 | 18565243 | 26998. |
| 11 | Australia | Oceania | 2002 | 80.4 | 19546792 | 30688. |
| 12 | Australia | Oceania | 2007 | 81.2 | 20434176 | 34435. |
| 13 | Italy     | Europe  | 1952 | 65.9 | 47666000 | 4931.  |
| 14 | Italy     | Europe  | 1957 | 67.8 | 49182000 | 6249.  |
| 15 | Italy     | Europe  | 1962 | 69.2 | 50843200 | 8244.  |
| 16 | Italy     | Europe  | 1967 | 71.1 | 52667100 | 10022. |
| 17 | Italy     | Europe  | 1972 | 72.2 | 54365564 | 12269. |
| 18 | Italy     | Europe  | 1977 | 73.5 | 56059245 | 14256. |
| 19 | Italy     | Europe  | 1982 | 75.0 | 56535636 | 16537. |
| 20 | Italy     | Europe  | 1987 | 76.4 | 56729703 | 19207. |
| 21 | Italy     | Europe  | 1992 | 77.4 | 56840847 | 22014. |
| 22 | Italy     | Europe  | 1997 | 78.8 | 57479469 | 24675. |
| 23 | Italy     | Europe  | 2002 | 80.2 | 57926999 | 27968. |
| 24 | Italy     | Europe  | 2007 | 80.5 | 58147733 | 28570. |

## 6.9 Exercise

Filter `gapminder` to all countries on the "Oceania" continent for just the years 1987 and 1992 and select just the `country`, `year`, and `gdpPercap` columns (and rename `gdpPercap` to be `gdp_per_cap`).

Save the output in an object called `gapminder_oceania`, and print `gapminder_oceania` to the console.

## 6.10 Solution

```
gapminder_oceania <- gapminder |>
  filter(continent == "Oceania", year %in% c(1987, 1992)) |>
  select(country, year, gdp_per_cap = gdpPercap)
gapminder_oceania
```

```
# A tibble: 4 x 3
  country      year gdp_per_cap
  <chr>     <dbl>      <dbl>
1 Australia    1987    21889.
2 Australia    1992    23425.
3 New Zealand 1987    19007.
4 New Zealand 1992    18363.
```

## 6.11 Adding and modifying columns using `mutate()`

Next, let's learn how to add and modify columns in our data frame using `mutate()`.

If I wanted to add a new column to my data, called `gdp`, which is the product of the `pop` and `gdpPercap` columns, I can do that using `mutate()`.

```
gapminder |> mutate(gdp = pop * gdpPercap)
```

```
# A tibble: 1,704 x 7
  country   continent   year lifeExp     pop gdpPercap       gdp
  <chr>     <chr>     <dbl>   <dbl>   <dbl>      <dbl>      <dbl>
1 Afghanistan Asia      1952    28.8  8425333    779.  6567086330.
2 Afghanistan Asia      1957    30.3  9240934    821.  7585448670.
3 Afghanistan Asia      1962    32.0  10267083   853.  8758855797.
4 Afghanistan Asia      1967    34.0  11537966   836.  9648014150.
5 Afghanistan Asia      1972    36.1  13079460   740.  9678553274.
6 Afghanistan Asia      1977    38.4  14880372   786.  11697659231.
7 Afghanistan Asia      1982    39.9  12881816   978.  12598563401.
8 Afghanistan Asia      1987    40.8  13867957   852.  11820990309.
9 Afghanistan Asia      1992    41.7  16317921   649.  10595901589.
10 Afghanistan Asia     1997    41.8  22227415   635.  14121995875.
# i 1,694 more rows
```

Here, `gdp`, is the name of my new column, and `pop` and `gdpPercap` are existing columns in my data frame, so I don't need to use quotes.

Remember that the code above hasn't actually modified `gapminder`. To modify `gapminder` I would need to *reassign* `gapminder` to the mutated data frame: `gaminder <- gapminder |> mutate(gdp = pop * gdpPercap)`.

What this code has done is it has created a brand new column, `gdp`, and placed it at the end of my data frame (and printed out the resulting data frame without saving it as a new variable).

In this case, each value in the `gdp` column contains product of the corresponding values in the `pop` and `gdpPercap` columns.

As another example, if we wanted to create a new column that contained the population in millions, i.e., `pop` divided by 1 million, we could do that using:

```
gapminder |> mutate(pop_mil = pop / 1e6)
```

```
# A tibble: 1,704 x 7
  country   continent year lifeExp      pop gdpPercap pop_mil
  <chr>     <chr>    <dbl>   <dbl>     <dbl>    <dbl>    <dbl>
1 Afghanistan Asia     1952    28.8  8425333    779.    8.43
2 Afghanistan Asia     1957    30.3  9240934    821.    9.24
3 Afghanistan Asia     1962    32.0  10267083   853.   10.3
4 Afghanistan Asia     1967    34.0  11537966   836.   11.5
5 Afghanistan Asia     1972    36.1  13079460   740.   13.1
6 Afghanistan Asia     1977    38.4  14880372   786.   14.9
7 Afghanistan Asia     1982    39.9  12881816   978.   12.9
8 Afghanistan Asia     1987    40.8  13867957   852.   13.9
9 Afghanistan Asia     1992    41.7  16317921   649.   16.3
10 Afghanistan Asia    1997    41.8  22227415   635.   22.2
# i 1,694 more rows
```

Note that `1e6` is scientific notation for 1000000 (i.e., 1 followed by 6 0s).

While `mutate()` is often used to create *new* columns, it can also be used to *modify existing* columns. For example, the code below will modify the existing `lifeExp` column by rounding it to the nearest integer.

```
gapminder |> mutate(lifeExp = round(lifeExp))
```

```
# A tibble: 1,704 x 6
  country   continent year lifeExp      pop gdpPercap
  <chr>     <chr>    <dbl>   <dbl>     <dbl>    <dbl>
1 Afghanistan Asia     1952    29  8425333    779.
2 Afghanistan Asia     1957    30  9240934    821.
3 Afghanistan Asia     1962    32  10267083   853.
4 Afghanistan Asia     1967    34  11537966   836.
5 Afghanistan Asia     1972    36  13079460   740.
6 Afghanistan Asia     1977    38  14880372   786.
7 Afghanistan Asia     1982    40  12881816   978.
8 Afghanistan Asia     1987    41  13867957   852.
```

```

 9 Afghanistan Asia      1992      42 16317921      649.
10 Afghanistan Asia      1997      42 22227415      635.
# i 1,694 more rows

```

Note that no new columns have been added to the end of our `gapminder` output. The data frame contains the exact same columns as the original `gapminder` object, except the `lifeExp` column is now a rounded integer!

## 6.12 Exercise

Create the following data frame (there is a new `log_pop` column, and the `gdpPercap` column has been rounded to the nearest integer):

```

# A tibble: 1,704 x 7
  country   continent   year lifeExp     pop gdpPercap log_pop
  <chr>     <chr>     <dbl>   <dbl>     <dbl>     <dbl>     <dbl>
1 Afghanistan Asia     1952    28.8  8425333      779     15.9
2 Afghanistan Asia     1957    30.3  9240934      821     16.0
3 Afghanistan Asia     1962    32.0  10267083     853     16.1
4 Afghanistan Asia     1967    34.0  11537966     836     16.3
5 Afghanistan Asia     1972    36.1  13079460     740     16.4
6 Afghanistan Asia     1977    38.4  14880372     786     16.5
7 Afghanistan Asia     1982    39.9  12881816     978     16.4
8 Afghanistan Asia     1987    40.8  13867957     852     16.4
9 Afghanistan Asia     1992    41.7  16317921     649     16.6
10 Afghanistan Asia    1997    41.8  22227415     635     16.9
# i 1,694 more rows

```

## 6.13 Solution

```

gapminder |>
  mutate(log_pop = log(pop), gdpPercap = round(gdpPercap))

```

```

# A tibble: 1,704 x 7
  country   continent   year lifeExp     pop gdpPercap log_pop
  <chr>     <chr>     <dbl>   <dbl>     <dbl>     <dbl>     <dbl>
1 Afghanistan Asia     1952    28.8  8425333      779     15.9
2 Afghanistan Asia     1957    30.3  9240934      821     16.0

```

```

3 Afghanistan Asia      1962    32.0 10267083     853   16.1
4 Afghanistan Asia      1967    34.0 11537966     836   16.3
5 Afghanistan Asia      1972    36.1 13079460     740   16.4
6 Afghanistan Asia      1977    38.4 14880372     786   16.5
7 Afghanistan Asia      1982    39.9 12881816     978   16.4
8 Afghanistan Asia      1987    40.8 13867957     852   16.4
9 Afghanistan Asia      1992    41.7 16317921     649   16.6
10 Afghanistan Asia     1997    41.8 22227415     635   16.9
# i 1,694 more rows

```

## 6.14 Summarizing data frames using summarize()

The functions that we have discussed so far in this chapter (`select()`, `filter()` and `mutate()`) are all functions that can be used to modify your data frame.

In this section, we will introduce `summarize()`, which can be used to—you guessed it—*summarize* your data frame.

As an example, let's summarize our data frame by computing the mean `lifeExp` value across all rows in the dataset:

```
gapminder |> summarize(mean(lifeExp))
```

```
# A tibble: 1 x 1
`mean(lifeExp)`
<dbl>
1      59.5
```

You can read this as: “take the `gapminder` dataset *and then* summarize it by computing `mean(lifeExp)`, i.e., the mean of the `lifeExp` column”.

However, like all of the other functions we have used in this chapter, the output of `summarize()` function is itself a data frame (albeit with just a single row and column). But notice that the name of the column in our summary data frame is just the function that was computed, `mean(lifeExp)`. Wouldn't it be nice if we could give this column a nicer name? Fortunately, this is super easy to do by providing a name for our summary operation inside the `summary()` function:

```
gapminder |> summarize(mean_life_exp = mean(lifeExp))
```

```
# A tibble: 1 x 1
  mean_life_exp
  <dbl>
1      59.5
```

In this version, our one-row-one-column data frame has the column name `mean_life_exp`, instead of `mean(lifeExp)`.

It's also super easy to compute multiple summaries at once using our trusty comma:

```
gapminder |>
  summarize(mean_life_exp = mean(lifeExp),
            max_population = max(pop))
```

```
# A tibble: 1 x 2
  mean_life_exp max_population
  <dbl>          <dbl>
1      59.5      1318683096
```

You don't have to put each summary computation on a new line as I did here, but it makes it a bit easier to read (e.g., compared with `summarize(mean_life_exp = mean(lifeExp), max_population = max(pop))`).

## 6.15 Grouped operations with `group_by()`

Computing a `summary()` operation across all of the rows at once is nice and all, but I'll forgive you if you're sitting there thinking "Ok Rebecca, I know you love the tidyverse, and you want to pipe everything into everything else, but honestly it's just easier to use base R notation to do this, like:"

```
mean(gapminder$lifeExp)
```

```
[1] 59.47444
```

And my response to you would be: yeah. It is. But just wait. The next thing I'm going to show you will blow your mind.

What if I asked you to compute the average life expectancy again, but to do it separately *for each continent*.

While you could precede your `summarize()` operation with a `filter()` operation separately for each continent like this:

```
gapminder |> filter(continent == "Asia") |> summarize(mean(lifeExp))
```

```
# A tibble: 1 x 1
`mean(lifeExp)`
<dbl>
1           60.1
```

```
gapminder |> filter(continent == "Americas") |> summarize(mean(lifeExp))
```

```
# A tibble: 1 x 1
`mean(lifeExp)`
<dbl>
1           64.7
```

```
gapminder |> filter(continent == "Africa") |> summarize(mean(lifeExp))
```

```
# A tibble: 1 x 1
`mean(lifeExp)`
<dbl>
1           48.9
```

```
gapminder |> filter(continent == "Europe") |> summarize(mean(lifeExp))
```

```
# A tibble: 1 x 1
`mean(lifeExp)`
<dbl>
1           71.9
```

```
gapminder |> filter(continent == "Oceania") |> summarize(mean(lifeExp))
```

```
# A tibble: 1 x 1
`mean(lifeExp)`
<dbl>
1           74.3
```

Or even use a “for” loop (if you so desired...), it turns out that there is a better way!

The true value of the `summarize()` function lies in its friendship with the `group_by()` function. The following code concisely computes the average `lifeExp` separately for each `continent` by “grouping” the `gapminder` data frame by `continent` (using `group_by()`) *before* summarizing.

```
gapminder |>
  group_by(continent) |>
  summarize(mean_life_exp = mean(lifeExp))
```

```
# A tibble: 5 x 2
  continent mean_life_exp
  <chr>          <dbl>
1 Africa           48.9
2 Americas         64.7
3 Asia             60.1
4 Europe           71.9
5 Oceania          74.3
```

You can think about this as if `group_by()` is creating a separate data frame for each `continent` value and then it is computing the `summarize()` operation *separately* for each continent data frame, and it is then combining the summary output into a two-column data frame, where the first column contains the respective `continent` value, and the second column contains the result of the `summary()` operation for that particular continent.

Now that’s rad as heck!

## 6.16 Exercise

Use `group_by()` and `summarize()` to compute the standard deviation of the `gdpPercap` column separately for each country.

Your output should look like this:

```
# A tibble: 142 x 2
  country      sd_gdp
  <chr>        <dbl>
1 Afghanistan  978.
2 Albania      5937.
3 Algeria      6223.
```

```

4 Angola      5523.
5 Argentina   12779.
6 Australia   34435.
7 Austria     36126.
8 Bahrain     29796.
9 Bangladesh  1391.
10 Belgium    33693.
# i 132 more rows

```

## 6.17 Solution

```

gapminder |>
  group_by(country) |>
  summarize(sd_gdp = max(gdpPercap))

```

```

# A tibble: 142 x 2
  country      sd_gdp
  <chr>        <dbl>
1 Afghanistan  978.
2 Albania      5937.
3 Algeria      6223.
4 Angola       5523.
5 Argentina    12779.
6 Australia    34435.
7 Austria      36126.
8 Bahrain      29796.
9 Bangladesh   1391.
10 Belgium     33693.
# i 132 more rows

```

### 6.17.1 Grouping by multiple columns simultaneously

Just in case you weren't already impressed enough by the `group_by()`/`summarize()` duo, you can also do more sophisticated grouping operations, such as computing the average `lifeExp` for each continent-year *combination* by grouping by both `continent` and `year`:

```

# compute the average life expectancy for each continent-year combination
gapminder |>
  group_by(continent, year) |>
  summarize(mean_life_exp = mean(lifeExp))

```

```
`summarise()` has grouped output by 'continent'. You can override using the
`.groups` argument.
```

```
# A tibble: 60 x 3
# Groups: continent [5]
  continent year mean_life_exp
  <chr>     <dbl>        <dbl>
1 Africa      1952        39.1
2 Africa      1957        41.3
3 Africa      1962        43.3
4 Africa      1967        45.3
5 Africa      1972        47.5
6 Africa      1977        49.6
7 Africa      1982        51.6
8 Africa      1987        53.3
9 Africa      1992        53.6
10 Africa     1997        53.6
# i 50 more rows
```

With `filter()`, `mutate()`, `group_by()`, and `summarize()` up your sleeve, there is almost no summarization of your data you can't do!

## 6.18 Exercise

Compute the mean and standard deviation of the GDP (the product of `pop` and `gdpPercap`) separately for each continent and year after the year 2000. Your output should look like this:

```
# A tibble: 10 x 3
# Groups: continent [5]
  continent year   `mean(gdp)`
  <chr>     <dbl>        <dbl>
1 Africa      2002 35303511424.
2 Africa      2007 45778570846.
3 Americas    2002 661248623419.
4 Americas    2007 776723426068.
5 Asia        2002 458042336179.
6 Asia        2007 627513635079.
7 Europe      2002 436448815097.
8 Europe      2007 493183311052.
9 Oceania     2002 345236880176.
10 Oceania     2007 403657044512.
```

## 6.19 Hint

My suggested order of operations is

```
gapminder |>
  filter() |>
  mutate() |>
  group_by() |>
  summarize()
```

## 6.20 Solution

```
gapminder |>
  filter(year > 2000) |>
  mutate(gdp = pop * gdpPercap) |>
  group_by(continent, year) |>
  summarize(mean(gdp))
```

`summarise()` has grouped output by 'continent'. You can override using the `groups` argument.

```
# A tibble: 10 x 3
# Groups:   continent [5]
  continent   year   `mean(gdp)`
  <chr>     <dbl>     <dbl>
1 Africa      2002 35303511424.
2 Africa      2007 45778570846.
3 Americas    2002 661248623419.
4 Americas    2007 776723426068.
5 Asia        2002 458042336179.
6 Asia        2007 627513635079.
7 Europe      2002 436448815097.
8 Europe      2007 493183311052.
9 Oceania     2002 345236880176.
10 Oceania     2007 403657044512.
```

### 6.20.1 Grouped mutates

Although `group_by()` is most often used with `summarize()`, this doesn't mean that it can *only* be used with `summarize()`!

Below, I group by `continent` and then conduct a `mutate()` to add a new column `max_life_exp`, containing the maximum life expectancy for the corresponding country. This time, I save the resulting data frame in a new variable called `gapminder_new`:

```
gapminder_new <- gapminder |>
  group_by(country) |>
  mutate(max_life_exp = max(lifeExp))
# print the first 30 rows of gapminder
print(gapminder_new, n = 30)
```

```
# A tibble: 1,704 x 7
# Groups:   country [142]
  country continent year lifeExp      pop gdpPercap max_life_exp
  <chr>     <chr>   <dbl>    <dbl>    <dbl>    <dbl>        <dbl>
1 Afghanistan Asia     1952    28.8  8425333    779.       43.8
2 Afghanistan Asia     1957    30.3  9240934    821.       43.8
3 Afghanistan Asia     1962    32.0  10267083   853.       43.8
4 Afghanistan Asia     1967    34.0  11537966   836.       43.8
5 Afghanistan Asia     1972    36.1  13079460   740.       43.8
6 Afghanistan Asia     1977    38.4  14880372   786.       43.8
7 Afghanistan Asia     1982    39.9  12881816   978.       43.8
8 Afghanistan Asia     1987    40.8  13867957   852.       43.8
9 Afghanistan Asia     1992    41.7  16317921   649.       43.8
10 Afghanistan Asia    1997    41.8  22227415   635.       43.8
11 Afghanistan Asia    2002    42.1  25268405   727.       43.8
12 Afghanistan Asia    2007    43.8  31889923   975.       43.8
13 Albania   Europe    1952    55.2  1282697   1601.      76.4
14 Albania   Europe    1957    59.3  1476505   1942.      76.4
15 Albania   Europe    1962    64.8  1728137   2313.      76.4
16 Albania   Europe    1967    66.2  1984060   2760.      76.4
17 Albania   Europe    1972    67.7  2263554   3313.      76.4
18 Albania   Europe    1977    68.9  2509048   3533.      76.4
19 Albania   Europe    1982    70.4  2780097   3631.      76.4
20 Albania   Europe    1987    72.0  3075321   3739.      76.4
21 Albania   Europe    1992    71.6  3326498   2497.      76.4
22 Albania   Europe    1997    73.0  3428038   3193.      76.4
23 Albania   Europe    2002    75.7  3508512   4604.      76.4
```

```

24 Albania      Europe    2007    76.4  3600523    5937.    76.4
25 Algeria     Africa    1952    43.1  9279525    2449.    72.3
26 Algeria     Africa    1957    45.7  10270856   3014.    72.3
27 Algeria     Africa    1962    48.3  11000948   2551.    72.3
28 Algeria     Africa    1967    51.4  12760499   3247.    72.3
29 Algeria     Africa    1972    54.5  14760787   4183.    72.3
30 Algeria     Africa    1977    58.0  17152804   4910.    72.3
# i 1,674 more rows

```

Take a close look at the new `max_life_exp` column that I've tacked onto the end of my data frame. Notice that it contains a single value for each country corresponding to the average `lifeExp` value computed using just the rows for that country.

### 6.20.2 Don't forget to ungroup()

So we've got our `gapminder_new` object that contains our `max_life_exp` column which contains the maximum life expectancy value where the average is computed just using the corresponding country's rows.

If I then wanted to conduct a subsequent summarize operation on this `gapminder_new` object, such as computing the mean of this new `max_life_exp` value, with the goal of computing this average *over all rows in the data* (i.e., I should get a single value), I might write the following code:

```
gapminder_new |> summarize(mean(max_life_exp))
```

```

# A tibble: 142 x 2
  country      `mean(max_life_exp)`
  <chr>          <dbl>
1 Afghanistan  43.8
2 Albania      76.4
3 Algeria      72.3
4 Angola        42.7
5 Argentina    75.3
6 Australia     81.2
7 Austria       79.8
8 Bahrain       75.6
9 Bangladesh    64.1
10 Belgium      79.4
# i 132 more rows

```

Is there anything surprising about the output here? The `summary()` operation is still *grouped by country*, even though I didn't conduct another `group_by(country)` operation before my `summarize()` operation!

This is because `gapminder_new` is not technically a simple data frame... it is a *grouped* data frame. Notice the text at the top of the output:

```
gapminder_new
```

```
# A tibble: 1,704 x 7
# Groups:   country [142]
  country continent year lifeExp      pop gdpPercap max_life_exp
  <chr>     <chr>   <dbl>    <dbl>    <dbl>    <dbl>        <dbl>
1 Afghanistan Asia     1952     28.8  8425333     779.       43.8
2 Afghanistan Asia     1957     30.3  9240934     821.       43.8
3 Afghanistan Asia     1962     32.0  10267083    853.       43.8
4 Afghanistan Asia     1967     34.0  11537966    836.       43.8
5 Afghanistan Asia     1972     36.1  13079460    740.       43.8
6 Afghanistan Asia     1977     38.4  14880372    786.       43.8
7 Afghanistan Asia     1982     39.9  12881816    978.       43.8
8 Afghanistan Asia     1987     40.8  13867957    852.       43.8
9 Afghanistan Asia     1992     41.7  16317921    649.       43.8
10 Afghanistan Asia    1997     41.8  22227415    635.       43.8
# i 1,694 more rows
```

It says `# Groups: country [142]`, which tells me that `gapminder_new` is *grouped* by the `country` column (and there are 142 groups). This means that any subsequent operations that I conduct on `gapminder_new` will also be grouped (by `country`).

If you are going to continue working with a data frame that was created using a `group_by()` operation, it is important to remember to `ungroup()`, unless you also want your subsequent operations to be grouped:

```
gapminder_new |>
  ungroup() |>
  summarize(mean(max_life_exp))
```

```
# A tibble: 1 x 1
`mean(max_life_exp)`<dbl>
1                      68.0
```

I could write all of this code without defining my intermediate `gapminder_new` object as follows:

```
gapminder |>
  group_by(country) |>
  mutate(max_life_exp = max(lifeExp)) |>
  ungroup() |>
  summarize(mean(max_life_exp))
```

```
# A tibble: 1 x 1
`mean(max_life_exp)`<dbl>
1                  68.0
```

But if I forgot the `ungroup()` operation (the second-last line above), I get:

```
gapminder |>
  group_by(country) |>
  mutate(max_life_exp = max(lifeExp)) |>
  summarize(mean(max_life_exp))
```

```
# A tibble: 142 x 2
  country      `mean(max_life_exp)`<dbl>
  1 Afghanistan    43.8
  2 Albania        76.4
  3 Algeria         72.3
  4 Angola          42.7
  5 Argentina       75.3
  6 Australia        81.2
  7 Austria          79.8
  8 Bahrain          75.6
  9 Bangladesh        64.1
  10 Belgium          79.4
# i 132 more rows
```

### 6.20.3 Grouped filtering

You can also conduct grouped filtering, which will apply your filter condition separately for each group. The most common scenario in which I find myself doing this is when I want to do

something like filtering to the row in each group with the maximum value in one of the columns, such as filtering to the rows with the highest `lifeExp` separately *within each continent*:

```
gapminder |>
  group_by(continent) |>
  filter(lifeExp == max(lifeExp))

# A tibble: 5 x 6
# Groups:   continent [5]
  country   continent   year lifeExp      pop gdpPercap
  <chr>     <chr>     <dbl>   <dbl>    <dbl>     <dbl>
1 Australia Oceania    2007    81.2  20434176  34435.
2 Canada    Americas   2007    80.7  33390141  36319.
3 Iceland   Europe    2007    81.8  301931    36181.
4 Japan     Asia      2007    82.6  127467972 31656.
5 Reunion   Africa    2007    76.4  798094    7670.
```

## 6.21 Count

Another really useful function is `count()`, which is used to summarize categorical (character/factor) variables.

`count()` creates a two-column data frame, where the first column displays the unique values of the provided column from the original data frame, and the second column, `n`, contains the number of times that each unique value appears:

```
gapminder |>
  count(continent)

# A tibble: 5 x 2
  continent     n
  <chr>       <int>
1 Africa        624
2 Americas      300
3 Asia          396
4 Europe        360
5 Oceania       24
```

This shows that the "Africa" continent value appears in the data 624 times, the "Americas" continent value appears 300 times, and so on.

## 6.22 Arrange

The final function I will show you in this chapter is `arrange()`, which lets you arrange the rows of your data frame in ascending or descending order of the values in a specific column. By default, `arrange()` will arrange the rows in ascending order of the values in the provided column.

The following code will rearrange all of the rows so that the row with the smallest `lifeExp` value will be at the top and the row with the largest `lifeExp` value will be at the bottom:

```
gapminder |>  
  arrange(lifeExp)
```

```
# A tibble: 1,704 x 6  
  country      continent  year lifeExp      pop gdpPercap  
  <chr>        <chr>     <dbl>    <dbl>     <dbl>      <dbl>  
1 Rwanda       Africa     1992    23.6  7290203     737.  
2 Afghanistan  Asia      1952    28.8  8425333     779.  
3 Gambia       Africa     1952     30    284320      485.  
4 Angola       Africa     1952    30.0  4232095    3521.  
5 Sierra Leone Africa     1952    30.3  2143249     880.  
6 Afghanistan  Asia      1957    30.3  9240934     821.  
7 Cambodia     Asia      1977    31.2  6978607     525.  
8 Mozambique   Africa     1952    31.3  6446316     469.  
9 Sierra Leone Africa     1957    31.6  2295678    1004.  
10 Burkina Faso Africa    1952   32.0  4469979     543.  
# i 1,694 more rows
```

For some reason, the way that you specify that the rows should be arranged in *descending* order instead is to wrap the variable name in the `desc()` function. The following code will arrange the `gapminder` rows so that the row with the largest `lifeExp` value will be at the top and the row with the smallest `lifeExp` value will be at the bottom:

```
gapminder |>  
  arrange(desc(lifeExp))
```

```
# A tibble: 1,704 x 6  
  country      continent  year lifeExp      pop gdpPercap  
  <chr>        <chr>     <dbl>    <dbl>     <dbl>      <dbl>  
1 Japan        Asia      2007    82.6  127467972    31656.  
2 Hong Kong, China Asia     2007    82.2  6980412     39725.
```

```

3 Japan           Asia      2002    82    127065841   28605.
4 Iceland        Europe    2007   81.8    301931    36181.
5 Switzerland    Europe    2007   81.7    7554661    37506.
6 Hong Kong, China Asia      2002   81.5    6762476    30209.
7 Australia      Oceania   2007   81.2    20434176   34435.
8 Spain          Europe    2007   80.9    40448191   28821.
9 Sweden         Europe    2007   80.9    9031088    33860.
10 Israel         Asia     2007   80.7    6426679    25523.
# i 1,694 more rows

```

Technically, you could also arrange by the negative of the column to arrange in descending order, but I usually use the `desc()` approach.

```
gapminder |>
  arrange(-lifeExp)
```

```

# A tibble: 1,704 x 6
  country       continent year lifeExp      pop gdpPercap
  <chr>        <chr>    <dbl>  <dbl>      <dbl>    <dbl>
1 Japan         Asia     2007    82.6 127467972   31656.
2 Hong Kong, China Asia     2007    82.2 6980412    39725.
3 Japan         Asia     2002    82    127065841   28605.
4 Iceland        Europe   2007   81.8    301931    36181.
5 Switzerland    Europe   2007   81.7    7554661    37506.
6 Hong Kong, China Asia     2002   81.5    6762476    30209.
7 Australia      Oceania  2007   81.2    20434176   34435.
8 Spain          Europe   2007   80.9    40448191   28821.
9 Sweden         Europe   2007   80.9    9031088    33860.
10 Israel         Asia    2007   80.7    6426679    25523.
# i 1,694 more rows

```

Here are a bunch of challenging exercises for you to test your dplyr skills. These are intentionally hard!

## 6.23 Exercise

Compute the *median* `lifeExp` and maximum `pop` values for each country, and then arrange the countries in descending order of their maximum `pop` value.

## 6.24 Solution

```
gapminder |>
  group_by(country) |>
  summarize(median_life_exp = median(lifeExp),
            max_pop = max(pop)) |>
  arrange(desc(max_pop))

# A tibble: 142 x 3
  country      median_life_exp    max_pop
  <chr>          <dbl>        <dbl>
1 China           64.7 1318683096
2 India            55.4 1110396331
3 United States    74.0 301139947
4 Indonesia       54.4 223547000
5 Brazil           62.4 190010647
6 Pakistan          55.1 169270617
7 Bangladesh        48.5 150448339
8 Nigeria           45.2 135031164
9 Japan              76.2 127467972
10 Mexico            66.2 108700891
# i 132 more rows
```

## 6.25 Exercise

Identify the 5 countries with the highest *average* life expectancy.

## 6.26 Solution

```
gapminder |>
  group_by(country) |>
  summarize(mean_life_exp = mean(lifeExp)) |>
  ungroup() |>
  arrange(desc(mean_life_exp)) |>
  head(5)

# A tibble: 5 x 2
  country      mean_life_exp
  <chr>          <dbl>
1 Japan           76.2
2 United States    74.0
3 United Kingdom   73.0
4 Australia        72.9
5 Sweden           72.8
```

```
<chr>           <dbl>
1 Iceland        76.5
2 Sweden         76.2
3 Norway         75.8
4 Netherlands    75.6
5 Switzerland    75.6
```

## 6.27 Exercise

What are the three most populous countries on the “Asia” continent?

## 6.28 Solution

```
gapminder |>
  filter(continent == "Asia") |>
  group_by(country) |>
  summarize(max_pop = max(pop)) |>
  ungroup() |>
  arrange(desc(max_pop)) |>
  head(3)
```

```
# A tibble: 3 x 2
  country      max_pop
  <chr>        <dbl>
1 China       1318683096
2 India        1110396331
3 Indonesia   223547000
```

## 6.29 Exercise

Identify the country with the highest total GDP for each continent.

## 6.30 Hint

Apply a `filter()` after a `group_by()` – this will apply the filtering separately for each group.

## 6.31 Solution

These are the countries with the highest total GDP for each continent:

```
gapminder |>
  mutate(gdp = gdpPercap * pop) |>
  group_by(continent) |>
  filter(gdp == max(gdp)) |>
  select(country, continent, gdp)
```

```
# A tibble: 5 x 3
# Groups:   continent [5]
  country      continent     gdp
  <chr>        <chr>       <dbl>
1 Australia    Oceania    7.04e11
2 China        Asia        6.54e12
3 Egypt        Africa     4.48e11
4 Germany      Europe     2.65e12
5 United States Americas 1.29e13
```

## 6.32 Exercise

Compute the average GDP per capita for each continent based only on countries with gdpPercap greater than 20,000.

## 6.33 Solution

```
gapminder |>
  filter(gdpPercap > 20000) |>
  group_by(continent) |>
  summarize(mean(gdpPercap))
```

```
# A tibble: 3 x 2
  continent `mean(gdpPercap)`
  <chr>           <dbl>
1 Africa          21569.
2 Americas        29810.
3 Asia            37442.
```

4 Europe                    27639.  
5 Oceania                25857.

# 7 Visualization with ggplot2

## 💡 Learn R live!

Prefer to learn via **live instruction**? Register for my [Introduction to R for Data Analysis](#) seminar via Instats on January 15-16 2025.

Now that we have learned how to manipulate our data, it's time to learn how to visualize it!

The “one tool to rule them all” for data visualization in R is the `ggplot2` library, originally created by Hadley Wickham. `Ggplot2`'s “layered grammar of graphics” equips us with a grammar for data visualization that is similar to the grammar we learned for data manipulation, which used the pipe to add `dplyr` operations together.

The “*gg*” in “*ggplot2*” stands for “*grammar of graphics*” and the “*2*” stands for “*2*” (as in, this is the second iteration of the `ggplot` library that Hadley Wickham created, the first being lost to the ether.)

In this chapter, we're going to continue working with the gapminder dataset, and since this is a new quarto document, to do that, we need to load it again:

```
library(tidyverse)
gapminder <- read_csv("data/gapminder.csv")
gapminder
```

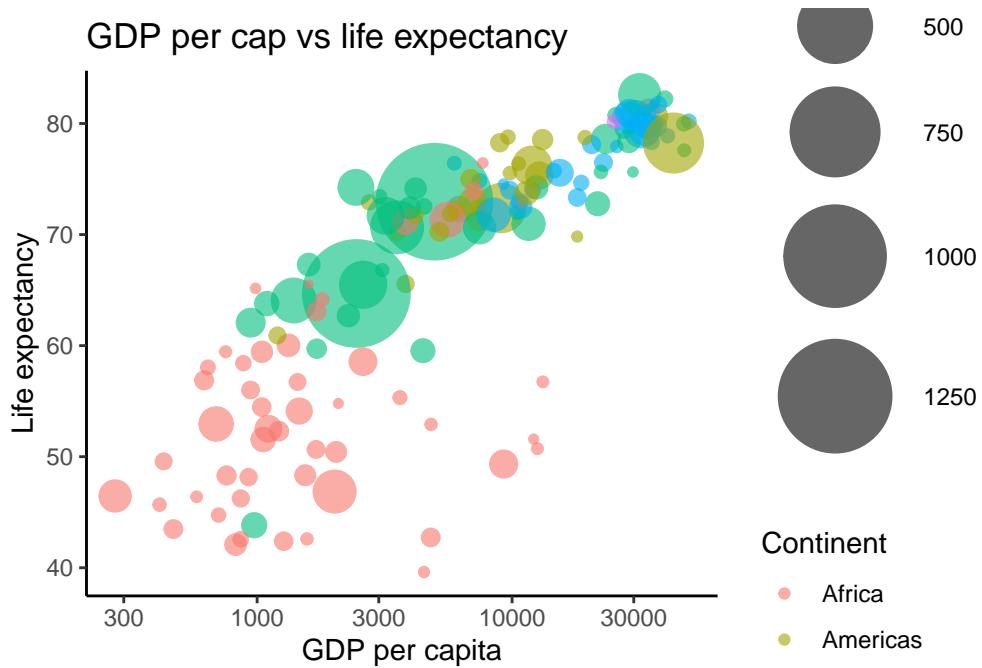
```
# A tibble: 1,704 x 6
  country   continent   year lifeExp     pop gdpPercap
  <chr>      <chr>    <dbl>   <dbl>     <dbl>      <dbl>
1 Afghanistan Asia      1952    28.8  8425333     779.
2 Afghanistan Asia      1957    30.3  9240934     821.
3 Afghanistan Asia      1962    32.0  10267083    853.
4 Afghanistan Asia      1967    34.0  11537966    836.
5 Afghanistan Asia      1972    36.1  13079460    740.
6 Afghanistan Asia      1977    38.4  14880372    786.
7 Afghanistan Asia      1982    39.9  12881816    978.
8 Afghanistan Asia      1987    40.8  13867957    852.
9 Afghanistan Asia      1992    41.7  16317921    649.
```

```
10 Afghanistan Asia      1997    41.8 22227415      635.  
# i 1,694 more rows
```

Note that I also loaded the tidyverse library again—it turns out that ggplot2, like the dplyr package from the previous chapter, is one of the core tidyverse packages. This means that rather than loading ggplot2 independently (`library(ggplot2)`), I typically just load the tidyverse library instead (`library(tidyverse)`), which will simultaneously load both the ggplot2 library and the dplyr library (along with a few others).

Our goal in this chapter is to learn how to write the code to create publication-ready data visualizations (as well as quick-and-dirty non-publication-ready visualizations—but those are less impressive). For example, with just a few lines of ggplot2 code, you can create this figure (click the “code” button to see the code):

```
gapminder |>  
  filter(year == 2007) |>  
  ggplot() +  
  geom_point(aes(x = gdpPercap,  
                 y = lifeExp,  
                 color = continent,  
                 size = pop / 1000000),  
             alpha = 0.6) +  
  scale_x_log10() +  
  scale_size_continuous(range = c(1, 20)) +  
  labs(x = "GDP per capita",  
       y = "Life expectancy",  
       title = "GDP per cap vs life expectancy",  
       size = "Population (millions)",  
       color = "Continent") +  
  theme_classic()
```



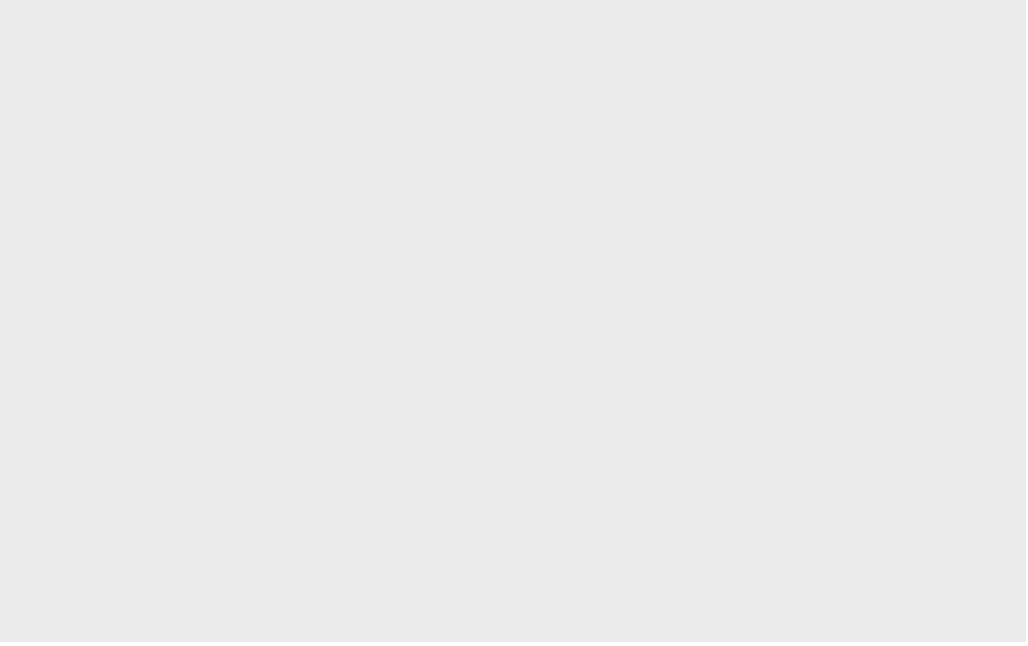
By the end of this chapter, you will be able to create a version of this plot yourself! However, it is worth noting what this chapter *won't* cover, which is the actual principles for creating effective data visualizations that tell a compelling story, and deciding *which* data visualizations to use to answer your specific question (or how to come up with good questions, for that matter). While I'd love to cover these things here, at the end of the day, this is an R book, which teaches you how to do practical things in R.

Fortunately, there are many resources that *do* teach these things, such as [Storytelling with Data](#) by Cole Nussbaumer Knaflic, which is a favorite of mine (and a great resource for learning how to produce effective graphics in general) and even the chapter on data visualization of my book with Bin Yu, [Veridical Data Science](#).

## 7.1 The layered grammar of graphics

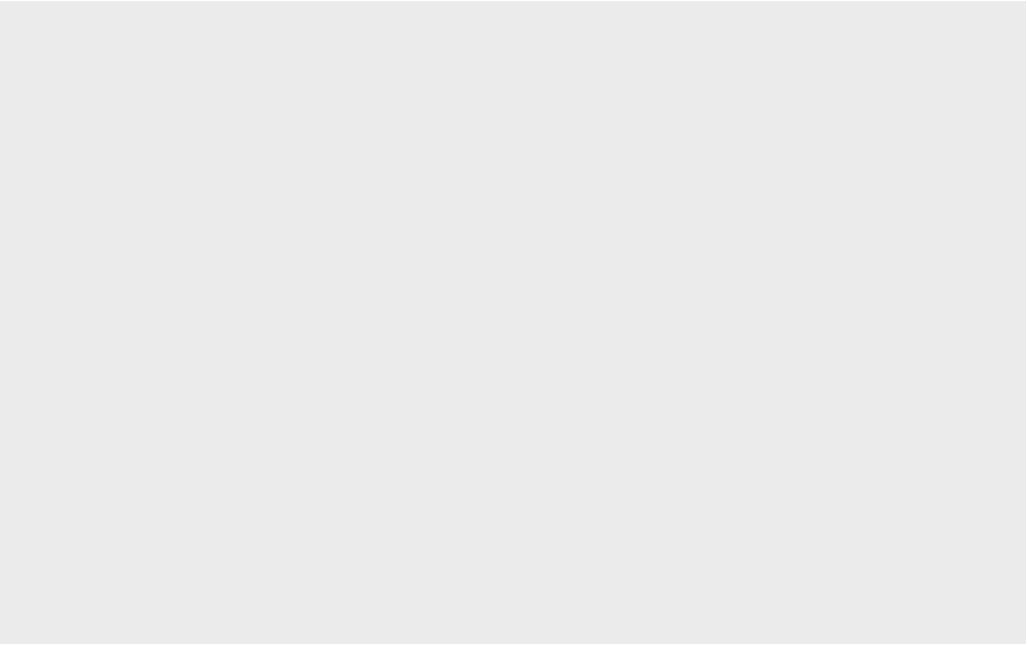
To create a ggplot figure, you start by creating an empty ggplot2 “canvas” using the `ggplot()` function. Our “canvas” here is the following grey box:

```
ggplot()
```



The first thing I need to do is to tell ggplot which dataset object (a data frame/tibble) to use to create my plot, and I do that by providing the name of my data object as the argument of `ggplot()`:

```
ggplot(gapminder)
```



Nothing has changed on our canvas, but now, when we add some “layers” to our plot, ggplot now knows where to look for the variables that I will refer to.

To *add* a layer to my plot, I literally use the plus symbol, `+`. The name of the layer that creates a scatterplot is `geom_point()` (because a scatterplot is made up of a collection of “points”).

I can add my points layer like this:

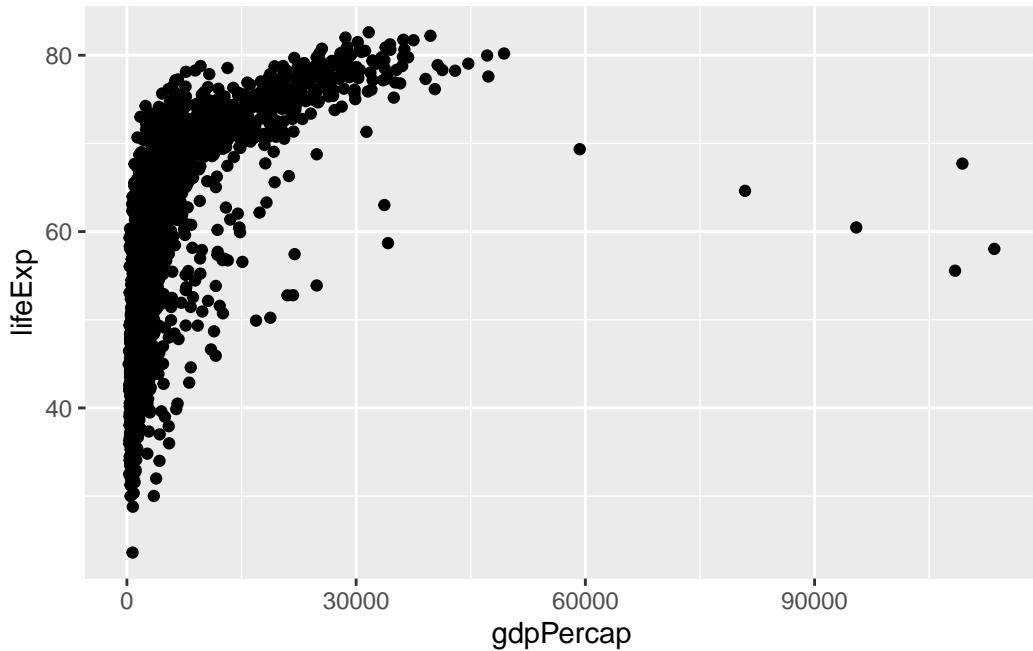
```
ggplot(gapminder) + geom_point()
```

```
Error in `geom_point()`:  
! Problem while setting up geom.  
i Error occurred in the 1st layer.  
Caused by error in `compute_geom_1()`:  
! `geom_point()` requires the following missing aesthetics: x and y.
```

But I got an error because I haven’t told ggplot which columns/variables in my data I want to use to define my scatterplot. Specifically, I need to tell it which columns should define the x- and y-coordinates of my scatterplot points.

I do that by providing an “aesthetics”, `aes()`, function as the argument of my points layer, in which I specify which column defines the x-coordinate (`x = gdpPercap`) and which column defines the y-coordinate (`y = lifeExp`).

```
ggplot(gapminder) +  
  geom_point(aes(x = gdpPercap, y = lifeExp))
```



Now we have our scatterplot, and ggplot has even very kindly provided x- and y-axis names!

Note the error that I get if I forget to place my x and y coordinates inside the `aes()` function, like this:

```
ggplot(gapminder) +
  geom_point(x = gdpPercap, y = lifeExp)
```

```
Error in eval(expr, envir, enclos): object 'gdpPercap' not found
```

Unfortunately, ggplot can only find your data frame columns (such as `gdpPercap`) when they are referenced inside the `aes()` function.

I like to think of the aesthetics function `aes()` as a secret code that tells ggplot that the objects I'm referring to are columns of my data frame.

A common mistake to make is to use a pipe `|>` instead of a `+` to add layers to your ggplot, like this:

```
ggplot(gapminder) |>
  geom_point(aes(x = gdpPercap, y = lifeExp))
```

```
Error in `geom_point()`:
! `mapping` must be created by `aes()`.
i Did you use `%>%` or `|>` instead of `+`?
```

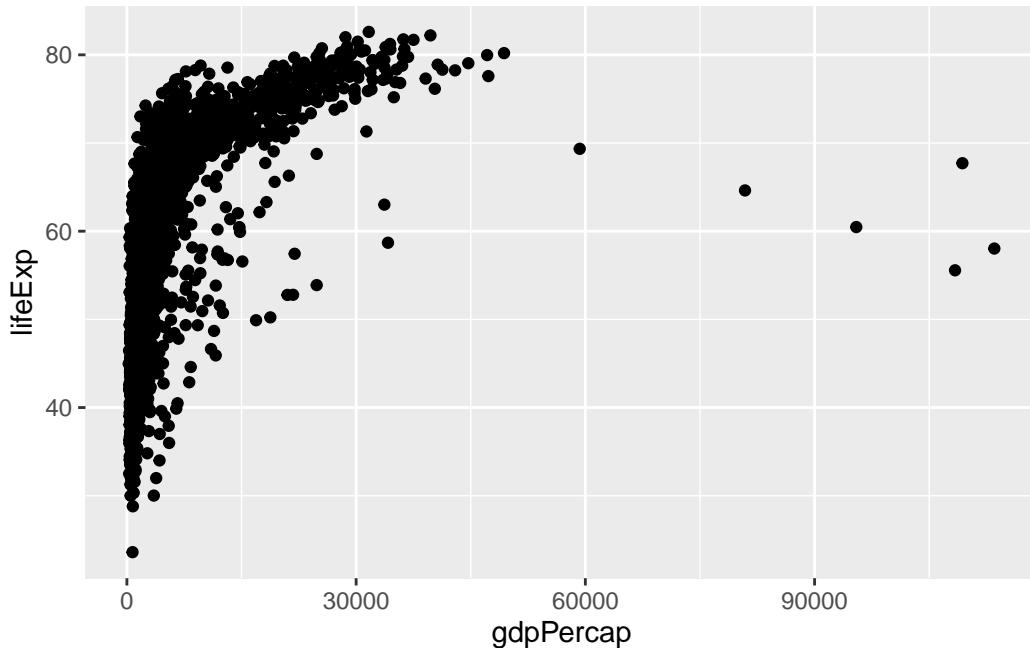
Fortunately, the error is quite helpful here—it says “*Did you use %>% or |> instead of +?*” This is hinting that the pipe on the first line of my code should have been a +.

If you remember that the pipe works by taking the object on its left-hand-side and placing it into the first argument of the function on its right-hand-side, then it kind of makes sense that the pipe doesn’t work for creating layered ggplot objects.

The code `ggplot(gapminder) |> geom_point(aes(x = gdpPercap, y = lifeExp))` would be equivalent to `geom_point(ggplot(gapminder), aes(x = gdpPercap, y = lifeExp))`, but the `geom_point()` function doesn’t want a `ggplot()` object as its first argument, it wants an `aes()` object!

Although I can’t use the pipe `|>` to create my layered ggplot2 figure, the `ggplot()` function itself wants our data object (`gapminder`, in this case) as its first argument, so I *can* pipe my *data* into my `ggplot()` function like this:

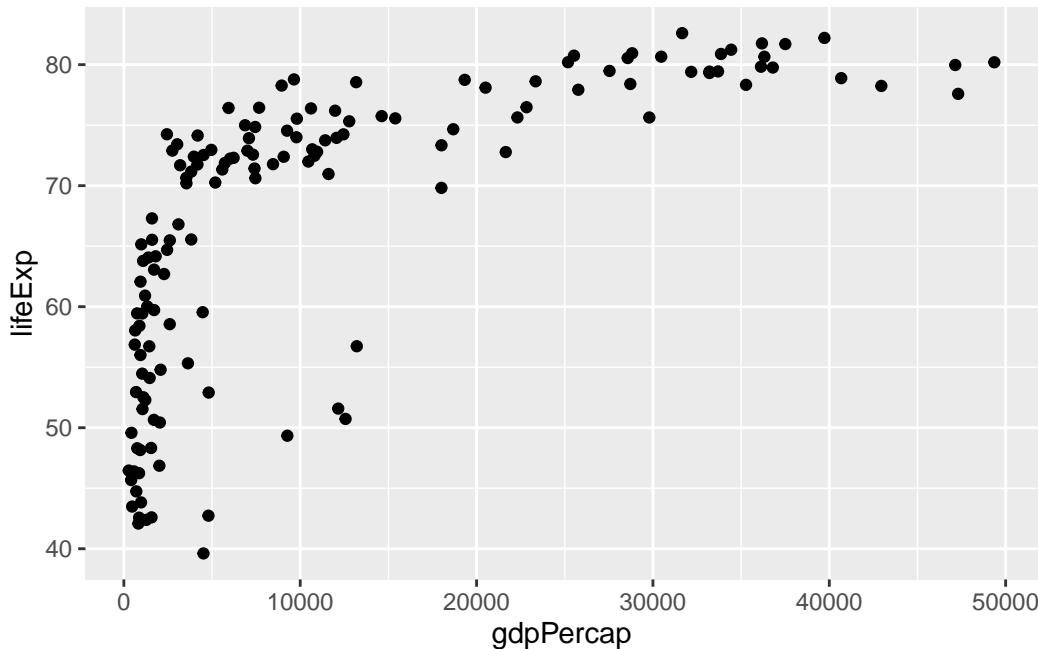
```
gapminder |>
  ggplot() +
  geom_point(aes(x = gdpPercap, y = lifeExp))
```



Why might I want to do this? I actually do this a lot, usually because I often want to make temporary minor modifications to my data before plotting it (but I don’t necessarily want to create a new intermediate object).

For example, if I want to recreate the scatterplot above just for the year 2007, I could conduct a filter step and then pipe the resulting filtered data frame object into `ggplot()`:

```
gapminder |>
  filter(year == 2007) |>
  ggplot() +
  geom_point(aes(x = gdpPercap, y = lifeExp))
```



Pay attention to where I have used `|>` and `+` in the code above!

#### ⚠ + versus `|>`

Probably one of the most common errors I make when doing data analysis is getting confused about when I should use `+` and when I should use `|>`.

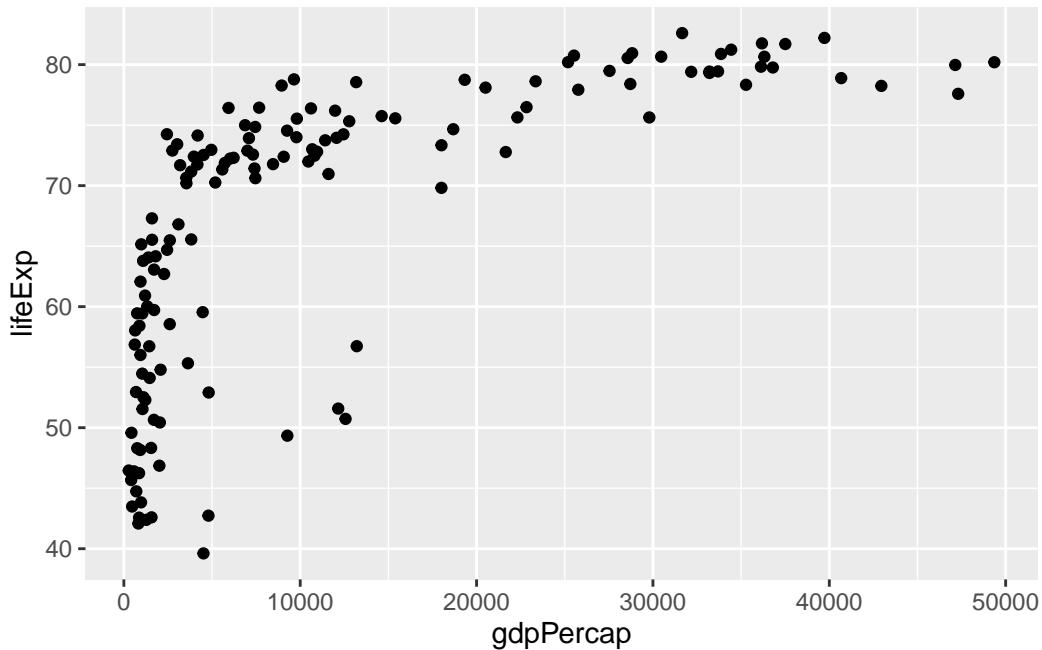
When we are adding ggplot layers, we always use `+`, but when we are chaining functions together, we use the pipe, `|>`.

To understand why, remember that the pipe, `|>` takes the object on the left and places it into the first argument of the function on the right. This is not what our ggplot2 functions are doing though, these are layering objects on top of one another, and so they use `+` instead of `|>`.

Alternatively, I could have defined a new object containing the `gapminder` data for 2007, and provided this filtered data frame object as the argument of the `ggplot()` function:

```
# define a new data frame
gapminder_2007 <- gapminder |> filter(year == 2007)
# provide this data frame as the argument of my ggplot() function
```

```
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPercap, y = lifeExp))
```



When do you think I might prefer to do the “all-at-once” approach:

```
gapminder |>  
  filter(year == 2007) |>  
  ggplot() +  
  geom_point(aes(x = gdpPercap, y = lifeExp))
```

versus defining an intermediate `gapminder_2007` object and then creating my plot with `ggplot(gapminder_2007)`:

```
gapminder_2007 <- gapminder |> filter(year == 2007)  
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPercap, y = lifeExp))
```

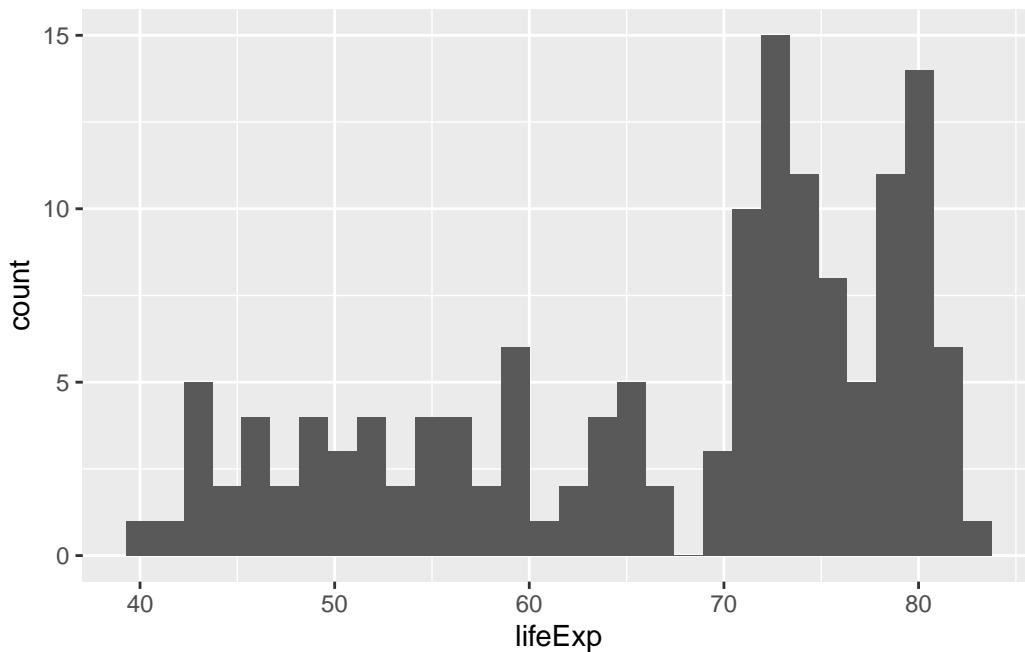
If I am going to use this filtered 2007 version of the data for anything other than this single plot (e.g., if I am going to create several plots using just the data from 2007), then I would prefer the latter approach, which defines the `gapminder_2007` object, rather than conducting the filtering every time. But if this is the only time I am going to use this 2007 data, then I would prefer the former approach, which avoids defining an unnecessary object, `gapminder_2007`.

In general, if you are going to be performing the same action multiple times, for example, to create several different plots, then it's more efficient to create an object that you can reuse.

Having defined `gapminder_2007`, I can now use it to create a new plot, this time a histogram of `lifeExp` values in 2007:

```
ggplot(gapminder_2007) +  
  geom_histogram(aes(x = lifeExp))
```

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



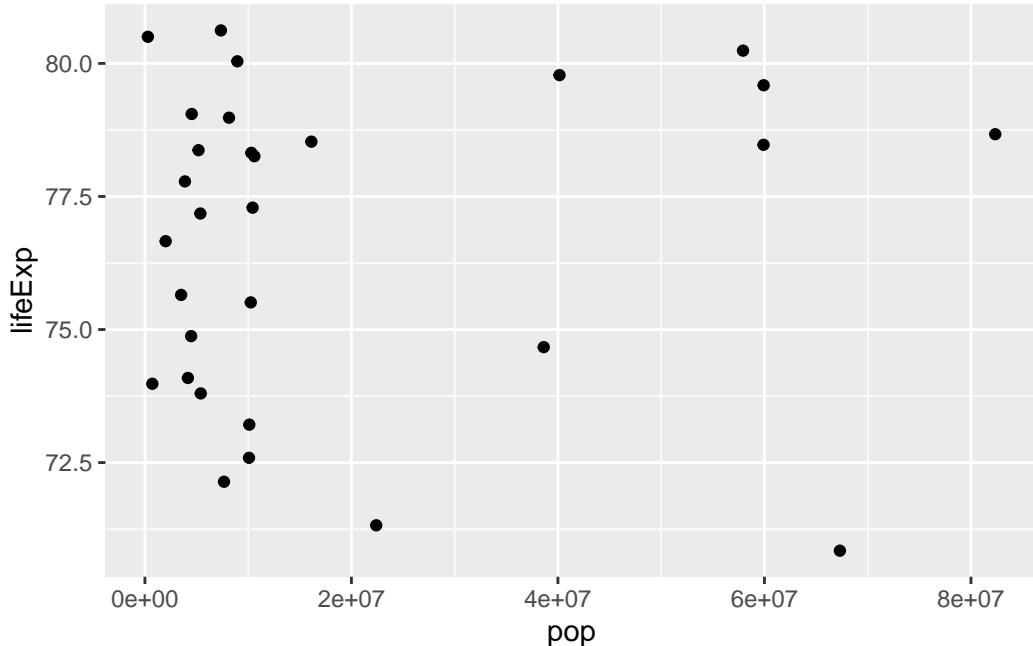
Note that to create a histogram using `geom_histogram()`, I just need to give it the x-axis variable, `lifeExp`, and it will do all of the binning and tallying up of counts needed to determine the y-axis for me.

## 7.2 Exercise

Create a ggplot scatterplot of population against life expectancy for all countries in Europe in 2002

### 7.3 Solution

```
gapminder |>
  filter(continent == "Europe", year == 2002) |>
  ggplot() +
  geom_point(aes(x = pop, y = lifeExp))
```



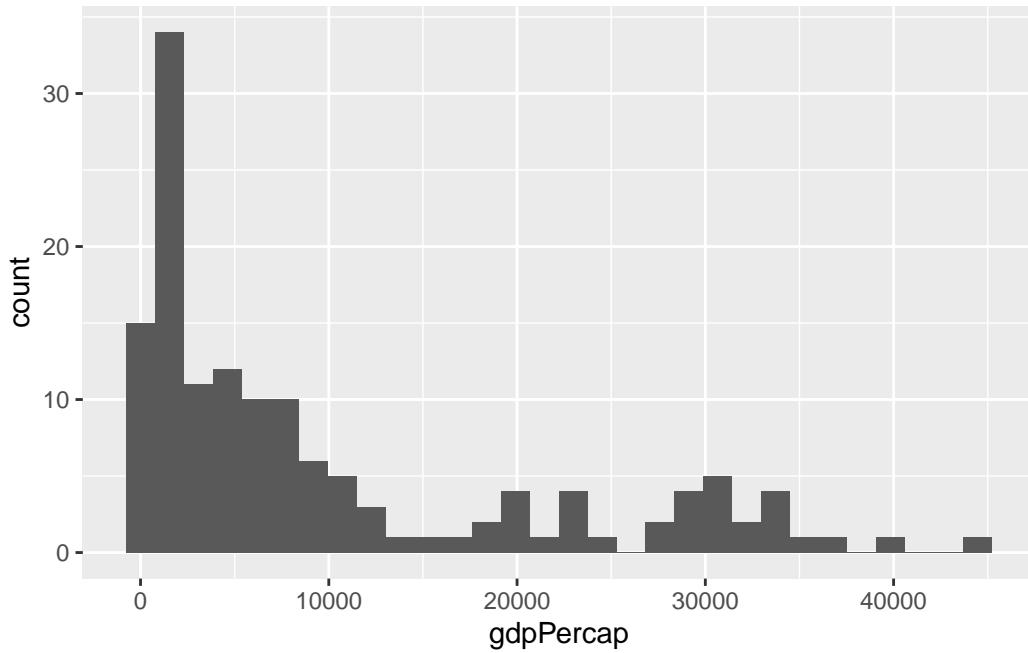
### 7.4 Exercise

Create a ggplot histogram of the GDP per capita in 2002

### 7.5 Solution

```
gapminder |>
  filter(year == 2002) |>
  ggplot() +
  geom_histogram(aes(x = gdpPercap))
```

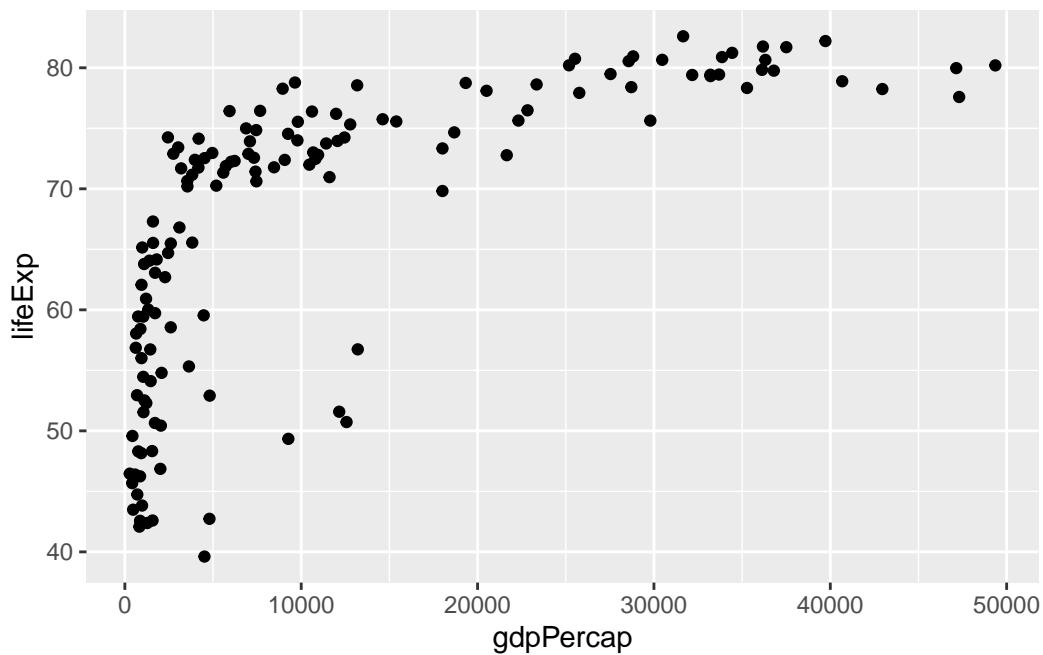
`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.



## 7.6 Global versus local aesthetics

In the examples above, I provided the aesthetic properties as an argument of the `geom_point()` and `geom_histogram()` layers of my `ggplot` object. However, I could have provided these aesthetic properties inside the initial `ggplot()` function itself, leaving the `geom_point()` function without any arguments:

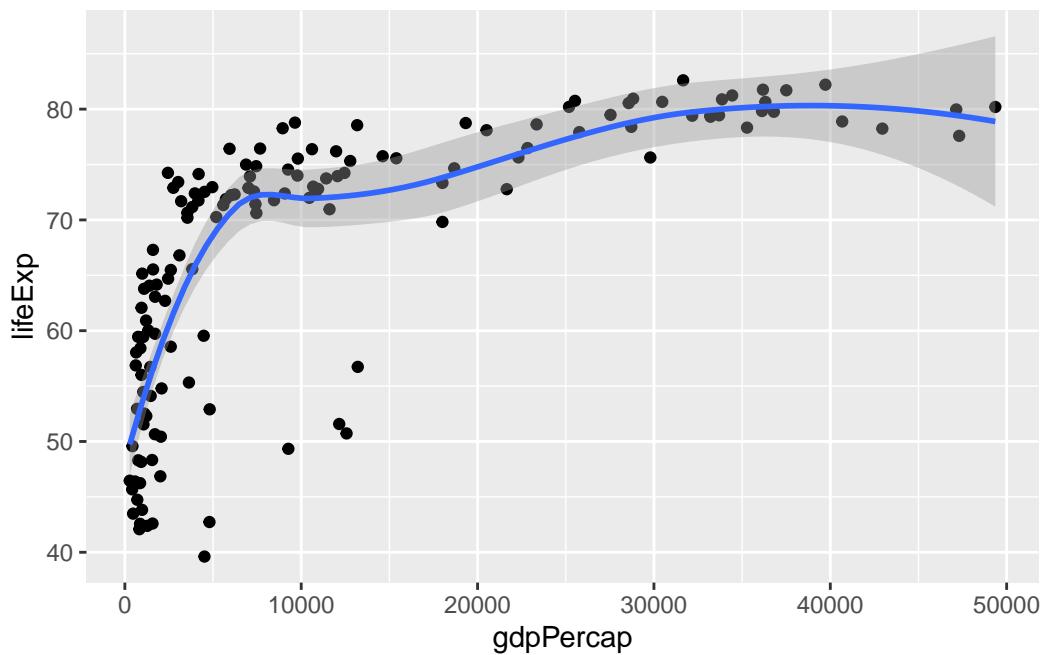
```
ggplot(gapminder_2007, aes(x = gdpPerCap, y = lifeExp)) +  
  geom_point()
```



This is common when you want to add many layers, all of which have the same aesthetic properties, for example, by adding a `geom_smooth()` layer, which will add a LOESS fitted curve to our scatterplot.

```
ggplot(gapminder_2007, aes(x = gdpPercap, y = lifeExp)) +  
  geom_point() +  
  geom_smooth()
```

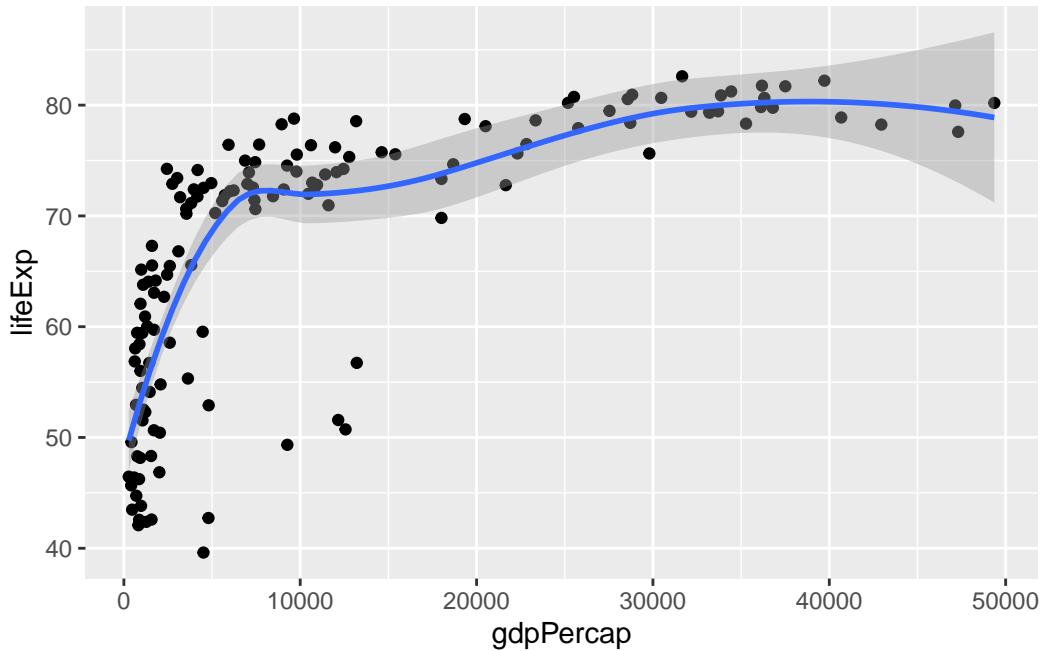
```
`geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```



I could specify the aesthetic properties separately in each layer, but this is less efficient since it involves repeating the `aes(x = gdpPercap, y = lifeExp)` code in each layer like this:

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap, y = lifeExp)) +
  geom_smooth(aes(x = gdpPercap, y = lifeExp))

`geom_smooth()` using method = 'loess' and formula = 'y ~ x'
```



When you specify the aesthetics inside the `ggplot()` function, you are specifying **global** aesthetics that will be applied to all layers of your ggplot figure, but when you specify the aesthetics inside the individual `geom_` layers, you are specifying **local** aesthetics that will be applied to that layer only.

For whatever reason, I tend to find myself mostly specifying local aesthetics unless I have many layers all of which are using the same aesthetics. This is just my personal preference though, and it may differ from yours.

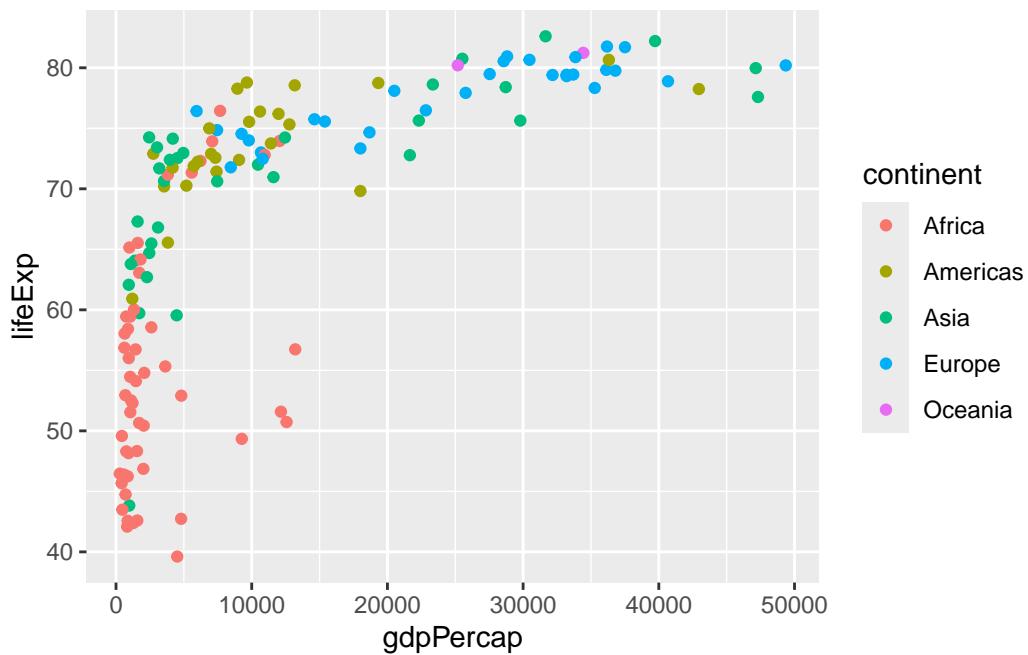
## 7.7 Additional ggplot2 aesthetics

So far we have seen that `x` and `y` are “aesthetic” properties of the points in a scatterplot, and `x` is an “aesthetic” property of the bars in a histogram. But they aren’t the *only* aesthetic properties that we can specify.

For example, some other scatterplot aesthetic properties that we can specify include `color`, `size`, and `shape`.

You can specify the `color` of the points using the `color` aesthetic:

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap, y = lifeExp, color = continent))
```

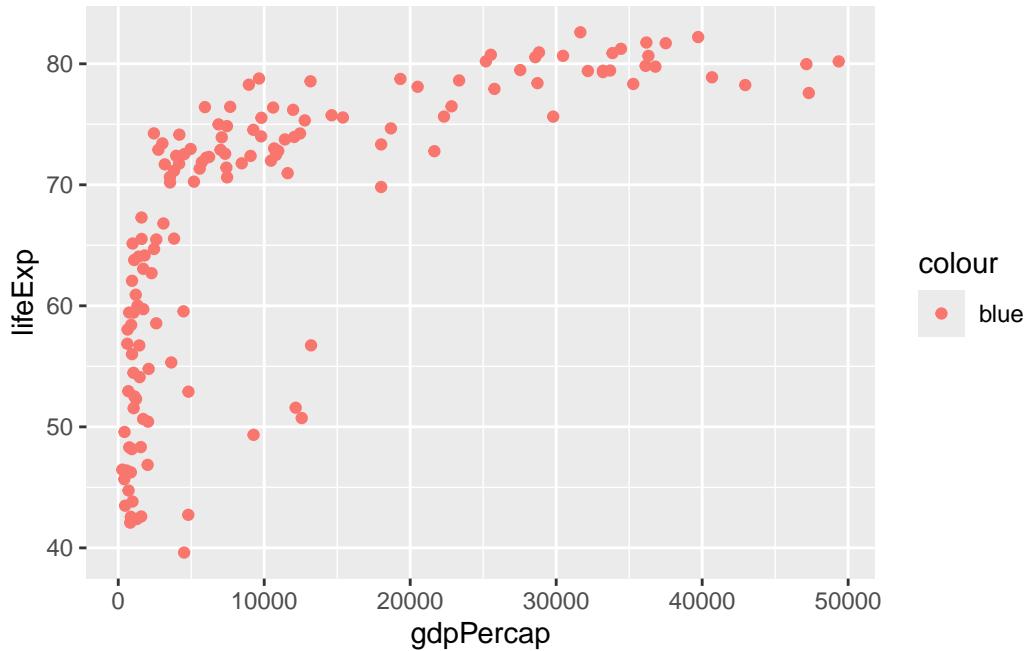


In this example, I'm specifying `color = continent` inside the `aes()` function, which, because it is inside the `aes()` function, tells ggplot2 that `continent` is a column in my data and that it should come up with a unique color for each unique `continent` value.

What if I wanted to just make all of the points in my scatterplot “blue”, instead of based on the `continent` column?

If I just replace `color = continent` with `color = "blue"` (where I'm providing quotes around “blue” because I want to specifically pass the *character* value “blue”), I get pink-red (salmon?) points instead of blue points!

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap, y = lifeExp, color = "blue"))
```

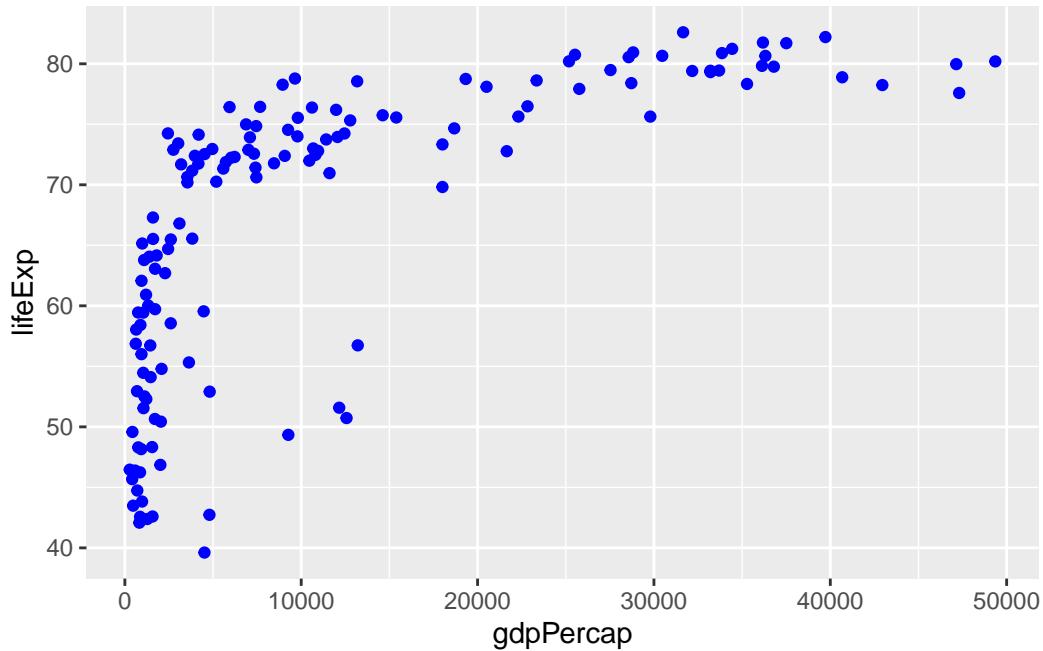


Why does this happen? The issue arises because a character value (rather than a column name) is provided inside the `aes()` function, which is intended for referencing columns of your data frame. When ggplot sees "blue" inside `aes()`, it temporarily creates a new column in the data frame filled entirely with the value "blue" for all data points. This effectively creates a categorical variable with only one category: "blue".

Since this new "column" has just one unique value, ggplot assigns a single color to represent it. However, ggplot doesn't care what the value is—it just uses the first default color from the ggplot2 palette, which happens to be this nice salmony color (and definitely not blue).

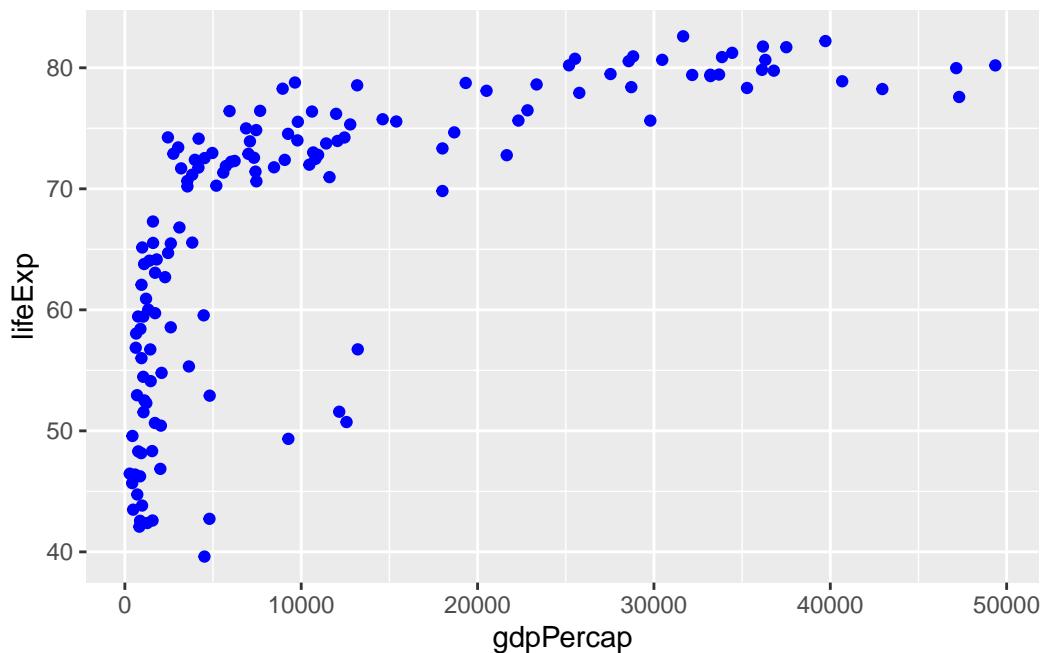
If you want to define an aesthetic of your plot that does *not* depend on a column in your data, you need to specify it *outside* the `aes()` function. So if we just move the `color = "blue"` argument *outside* `aes()`, we get what we wanted (pay close attention to the closing parentheses and compare with the code in the previous chunk):

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap, y = lifeExp), color = "blue")
```



Note that when I start having several aesthetic properties, I tend to place each one on its own line, but pay attention to the indentation of each line. Arguments of the inner `aes()` function, such as `x` and `y` are placed further to the right than arguments of the outer `geom_point()` function (such as `color`). RStudio will do this automatically for you when you hit “return” to move an argument to a new line. This indentation makes it a bit easier to see which arguments are for which function in a series of nested functions.

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap,
                 y = lifeExp),
             color = "blue")
```



💡 Keyboard shortcut for fixing code indentation

A handy keyboard shortcut for fixing the indentation of your code in RStudio is to highlight the misaligned code and use Cmd + I.

This shortcut will turn the following code with wacky nonsensical indentation:

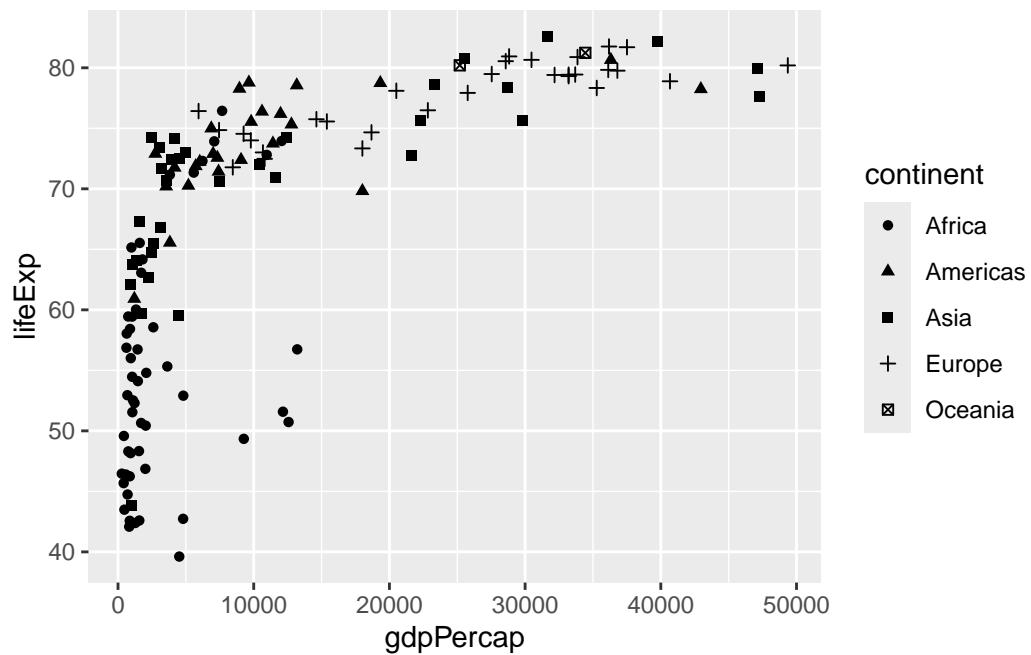
```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap,
                 y = lifeExp),
             color = "blue")
```

into nice, properly indented code like this:

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap,
                 y = lifeExp),
             color = "blue")
```

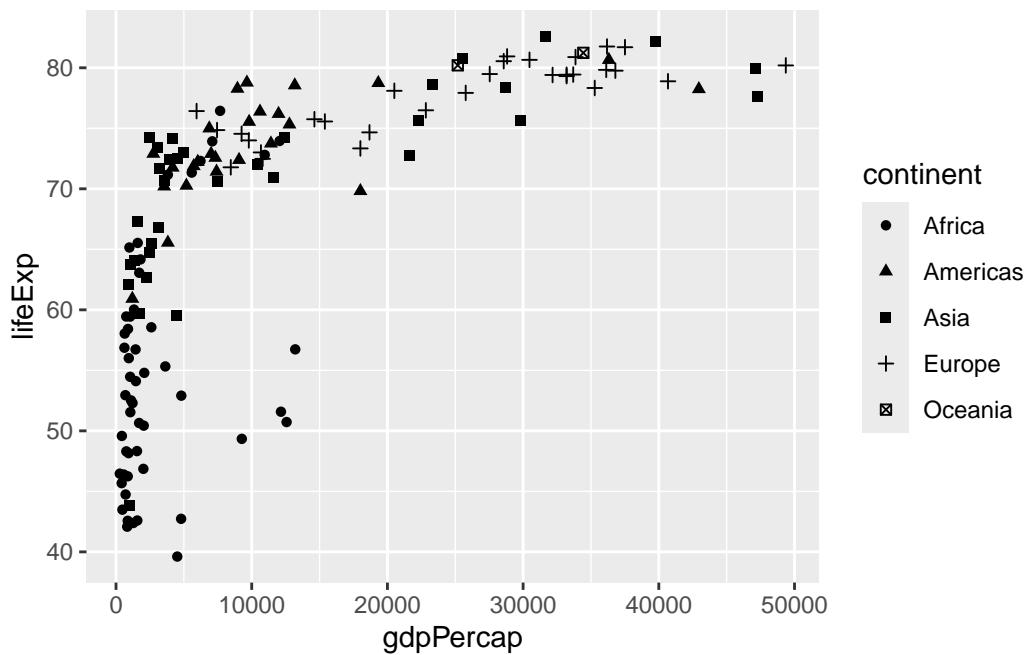
## 7.8 Exercise

Recreate the scatterplot of `lifeExp` and `gdpPercap` in 2007, but use the `continent` column to specify the `shape` aesthetic like this:



## 7.9 Solution

```
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPercap,  
                 y = lifeExp,  
                 shape = continent))
```

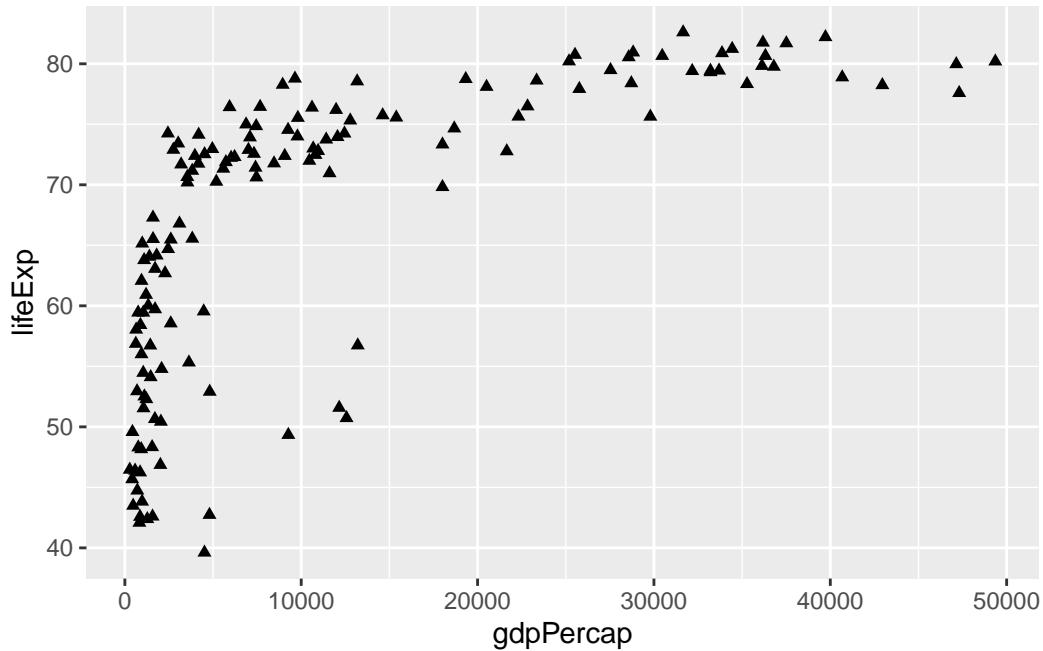


## 7.10 Exercise

Recreate the scatterplot of `lifeExp` and `gdpPercap` in 2007, but make *all* points have a “triangle” shape.

## 7.11 Solution

```
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPercap,  
                 y = lifeExp),  
             shape = "triangle")
```

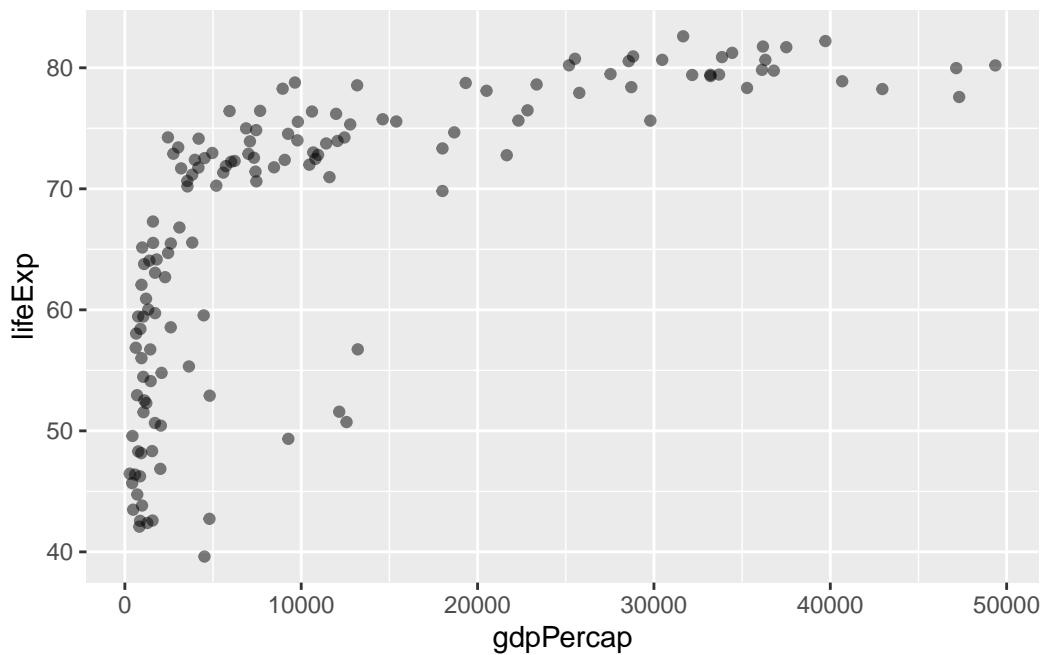


### 7.11.1 Transparency

Sometimes when you have a lot of data points all sitting on top of one another, it can be helpful to add some transparency. You can do this using the `alpha` argument.

`alpha` takes values between 0 and 1. `alpha = 1` is not transparent at all, and `alpha = 0` is completely transparent. The scatterplot below has `alpha = 0.5`:

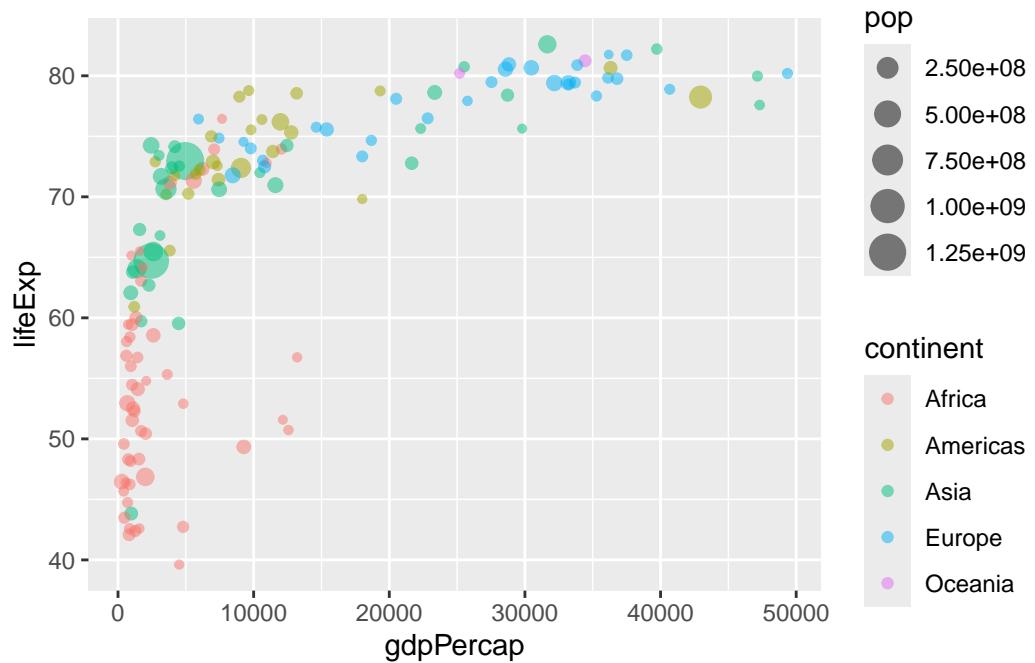
```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap,
                 y = lifeExp),
             alpha = 0.5)
```



Since we are not using a column/variable in the data frame to specify `alpha`, note that it is *outside* the `aes()` function of `geom_point()`.

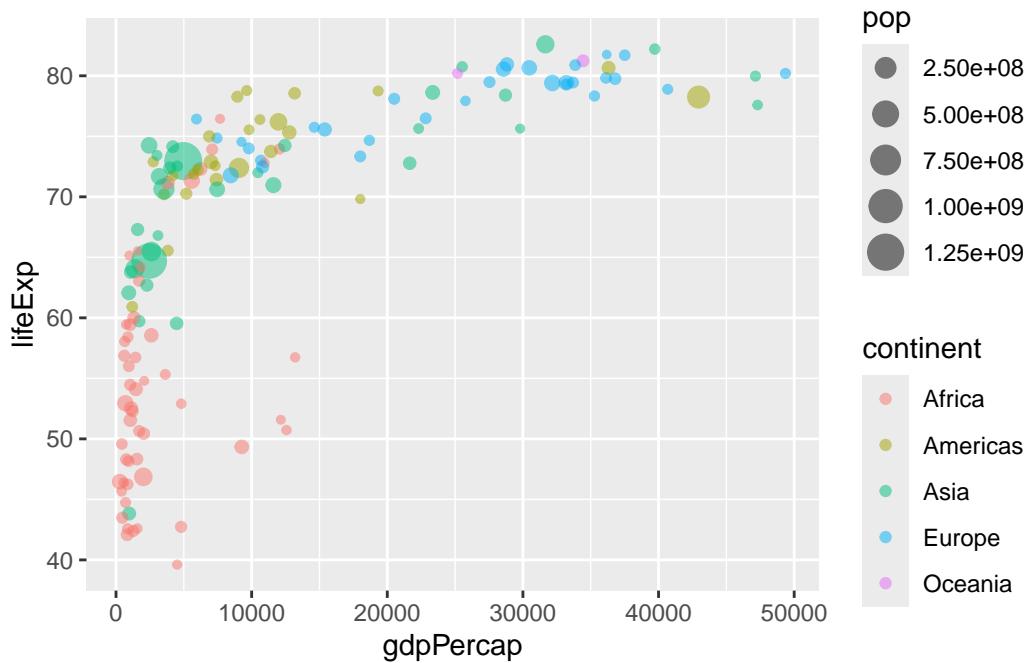
## 7.12 Exercise

Recreate the 2007 `gdpPercap` vs `lifeExp` plot where each point has color determined by `continent`, size determined by `pop`, and all the points have a transparency of 0.5 like this:



## 7.13 Solution

```
ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap,
                 y = lifeExp,
                 color = continent,
                 size = pop),
             alpha = 0.5)
```



## 7.14 Other kinds of plots

### 7.14.1 Line plots

Line plots are great for showing how things change over time.

If I want to see how `lifeExp` changes by year, I can try to create a line plot using `geom_line()` with `lifeExp` on the y-axis, and `year` on the x-axis:

```
ggplot(gapminder) +
  geom_line(aes(x = year, y = lifeExp))
```



Ugh. gross. I don't like this plot at all. It looks terrible. What's with all the zigzags?

Can you figure out what's going on in this plot? As a hint... how many `lifeExp` values do we have for each `year`? We have many! One for each country (and there are almost 200 countries!).

Here are all the `lifeExp` values corresponding to 1962

```
gapminder |>
  filter(year == 1962) |>
  select(year, country, lifeExp)
```

```
# A tibble: 142 x 3
  year country    lifeExp
  <dbl> <chr>      <dbl>
1 1962 Afghanistan 32.0
2 1962 Albania     64.8
3 1962 Algeria     48.3
4 1962 Angola       34
5 1962 Argentina   65.1
6 1962 Australia   70.9
7 1962 Austria     69.5
8 1962 Bahrain     56.9
9 1962 Bangladesh  41.2
```

```
10 1962 Belgium      70.2
# i 132 more rows
```

So the vertical lines we see in our “line plot” above correspond to the range of `lifeExp` values for each year, and then it probably just connects the final `lifeExp` value that year to the first `lifeExp` value for the next year, and those are the diagonal lines that we see.

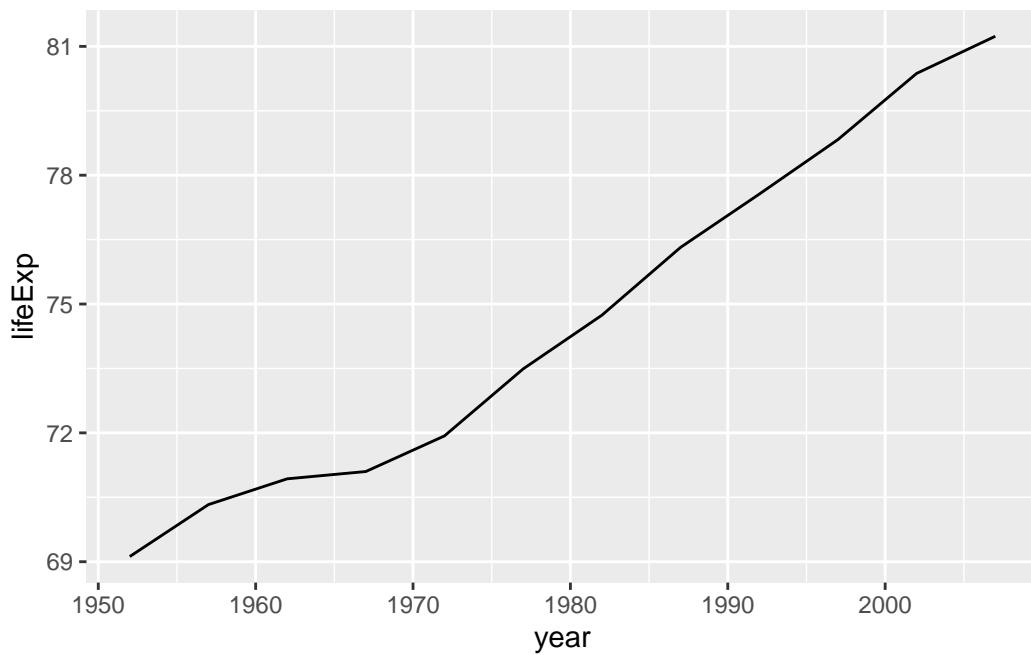
In general, to create a single line, we want just *one* value for the y-axis (e.g., `lifeExp`) per x-axis value (e.g., `year`). To satisfy this requirement, we can look at the data for just *one* country:

```
gapminder |>
  filter(country == "Australia") |>
  select(year, country, lifeExp)
```

```
# A tibble: 12 x 3
  year   country   lifeExp
  <dbl>   <chr>     <dbl>
1 1952 Australia   69.1
2 1957 Australia   70.3
3 1962 Australia   70.9
4 1967 Australia   71.1
5 1972 Australia   71.9
6 1977 Australia   73.5
7 1982 Australia   74.7
8 1987 Australia   76.3
9 1992 Australia   77.6
10 1997 Australia   78.8
11 2002 Australia   80.4
12 2007 Australia   81.2
```

Now, we have just one `lifeExp` value for each `year`, and we could create a line plot using these values:

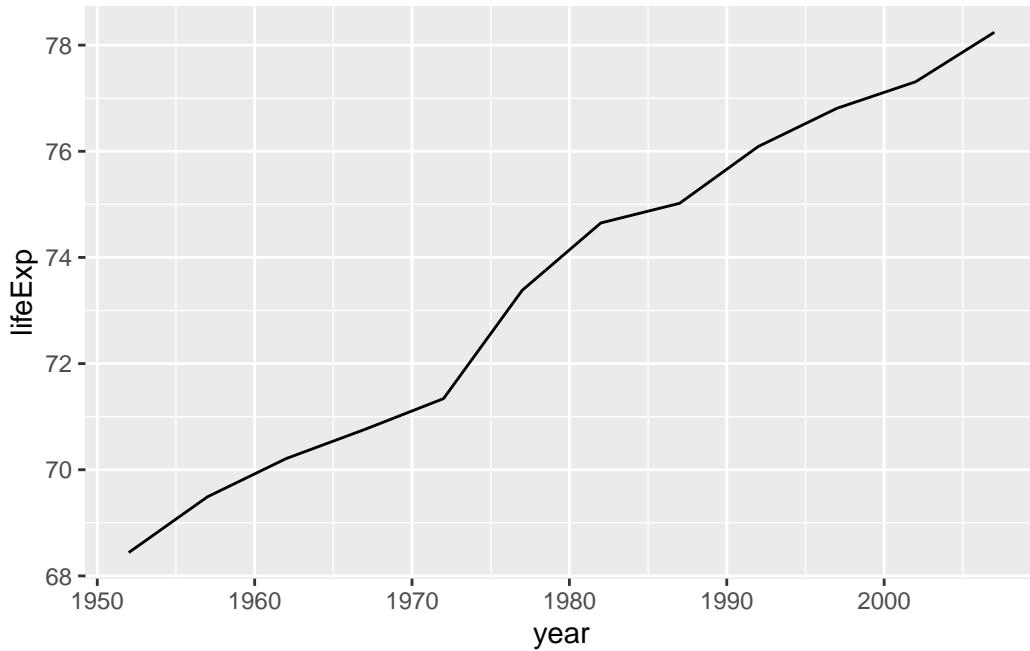
```
gapminder |>
  filter(country == "Australia") |>
  ggplot() +
  geom_line(aes(x = year, y = lifeExp))
```



Gee, wiz! That looks way better! It's a single line, and boy-oh-boy it sure looks like we Aussies are living longer and longer! Onya, Mate!

I could make the same plot for the US, by filtering to the US instead of Australia:

```
gapminder |>
  filter(country == "United States") |>
  ggplot() +
  geom_line(aes(x = year, y = lifeExp))
```



But what if I wanted to make a plot with *both* of these lines on it?

There are at least two ways I could do that. One is good, and the other is not so good.

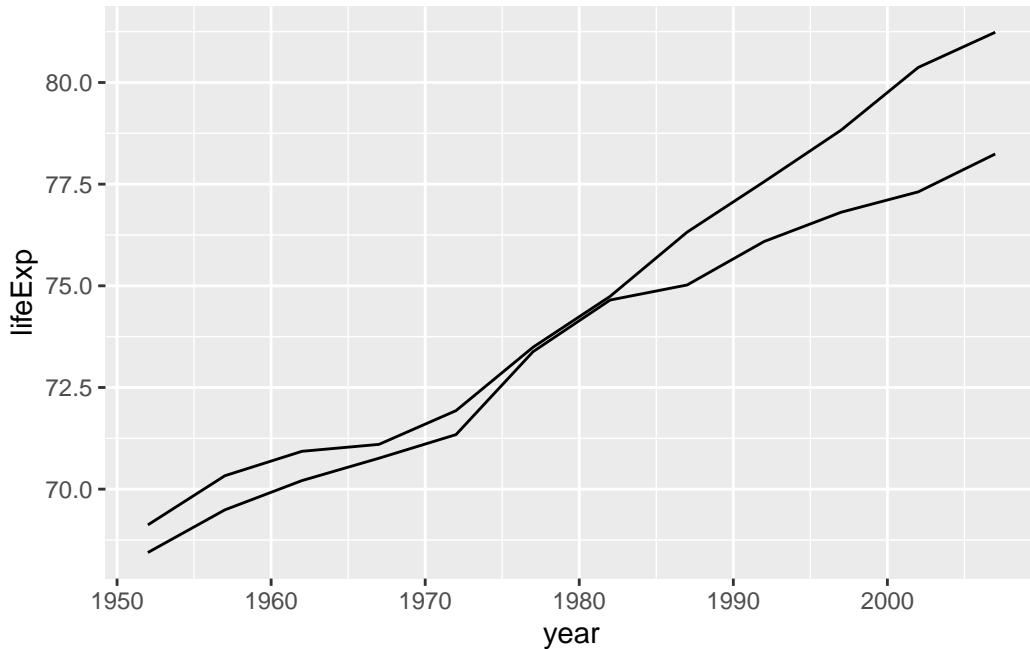
I'll show you the not-so-good approach first (so you can really appreciate the good approach.)

The not-so-good approach involves creating separate data frames for Australia and the US and adding a separate line layer for each country. The first line layer will be just using `gapminder_us`, the data frame for the US, and the second line layer will have its own `data` argument to which I'll pass `gapminder_au`, the data frame for Australia:

```
# define the data frame for the US
gapminder_us <- gapminder |>
  filter(country == "United States")

# define the data frame for the Australia
gapminder_au <- gapminder |>
  filter(country == "Australia")

# Create a line plot for the US and then add a line plot layer for Australia
ggplot(gapminder_us) +
  geom_line(aes(x = year, y = lifeExp)) +
  geom_line(aes(x = year, y = lifeExp), data = gapminder_au)
```



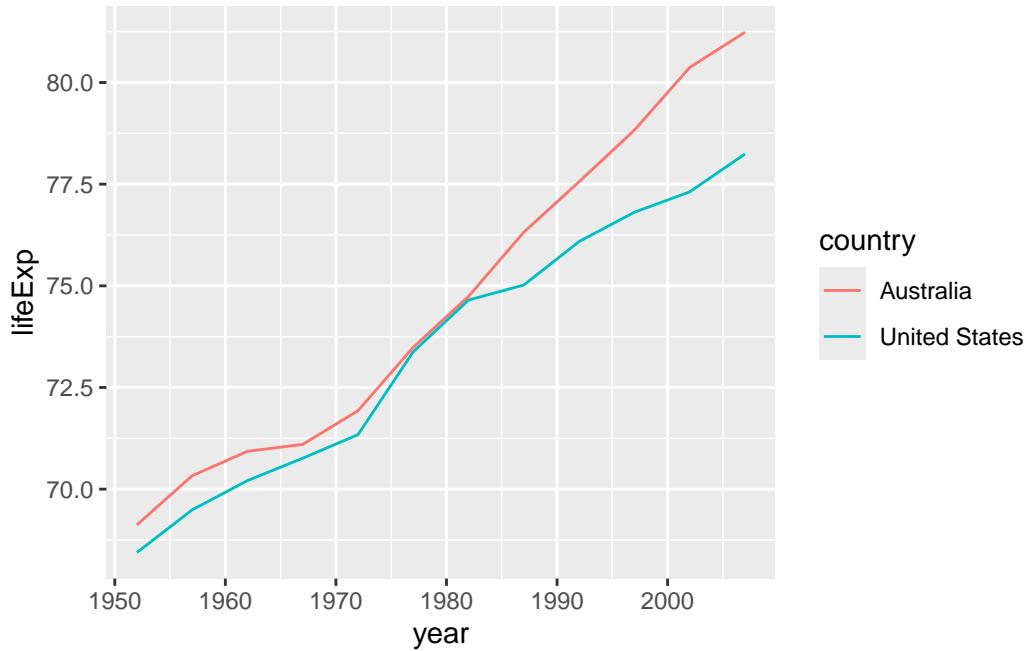
Here the first `geom_line()` layer is based on the “global” `gapminder_us` data frame provided as the argument of `ggplot()`, and the second line is based on the “local” `gapminder_au` data frame provided in the `data` argument of the second `geom_line()` layer (when you don’t provide a `data` argument, each layer will be based on the global data frame provided to `ggplot()`)

While this technically works, this approach isn’t great for a few reasons. First, I can’t tell which line is which. There is no legend (and it’s unfortunately not all that easy to add a legend manually to a `ggplot2` figure). Another reason this approach sucks is that it’s not scalable. If I wanted to do this for 10 countries, I’d have to create 10 different data frames and add 10 line layers to my plot. No thanks.

Instead of adding separate line layers for each country, I can use the `color` or `group` aesthetic to tell `ggplot()` that I want separate lines for each country.

In the code below, I create a single data frame that contains the data for Australia and the US only, and then I create a `ggplot2` line plot, specifying `color = country` inside my `aes()` function, which will give me a separate line for each country:

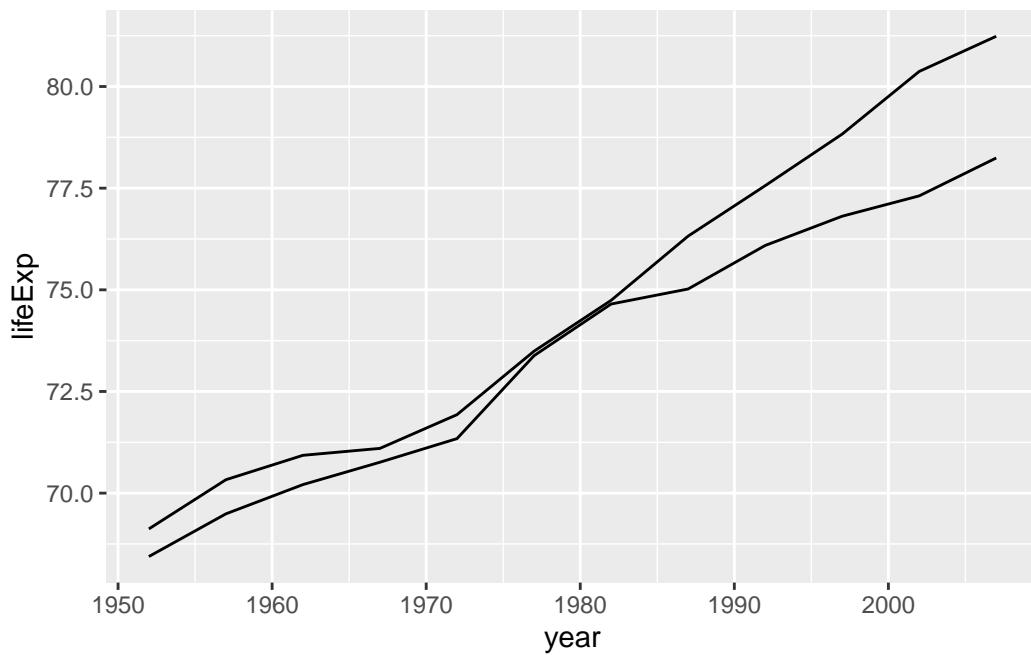
```
gapminder |>
  filter(country %in% c("Australia", "United States")) |>
  ggplot() +
  geom_line(aes(x = year,
                y = lifeExp,
                color = country))
```



Now, each country's line has a different color *and* ggplot has created a legend for me.

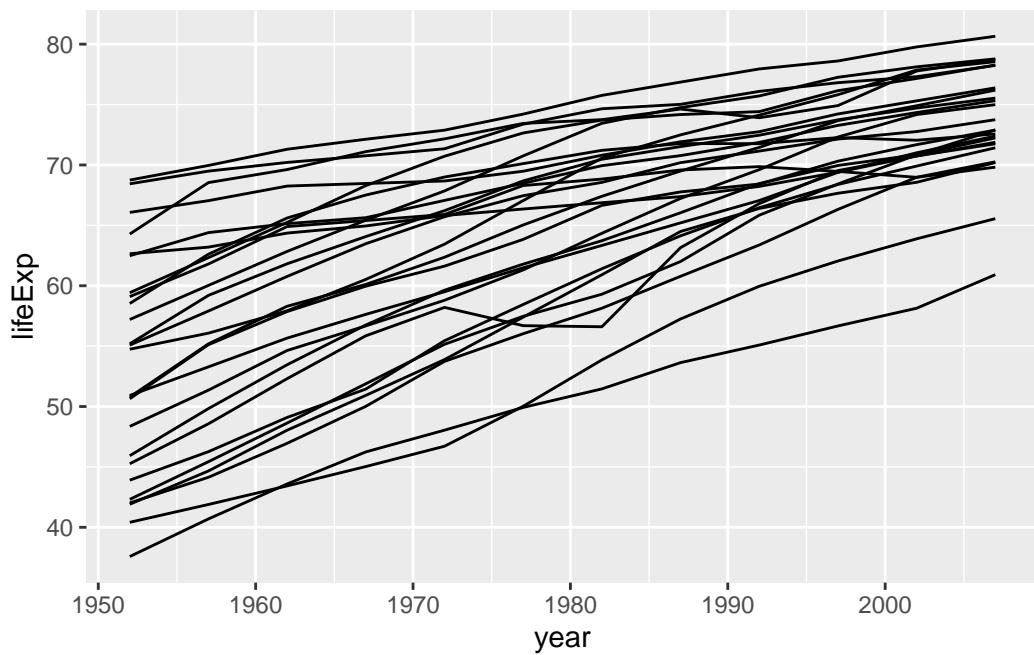
An alternative if I want a separate line for each country, but don't want each line to have a different color, is to use the `group` aesthetic instead of the `color` aesthetic:

```
gapminder |>
  filter(country %in% c("Australia", "United States")) |>
  ggplot() +
  geom_line(aes(x = year,
                y = lifeExp,
                group = country))
```



For example, the following code creates a line plot of `lifeExp` by `year` for each country on the entire “Americas” `content` (with no colors or legend).

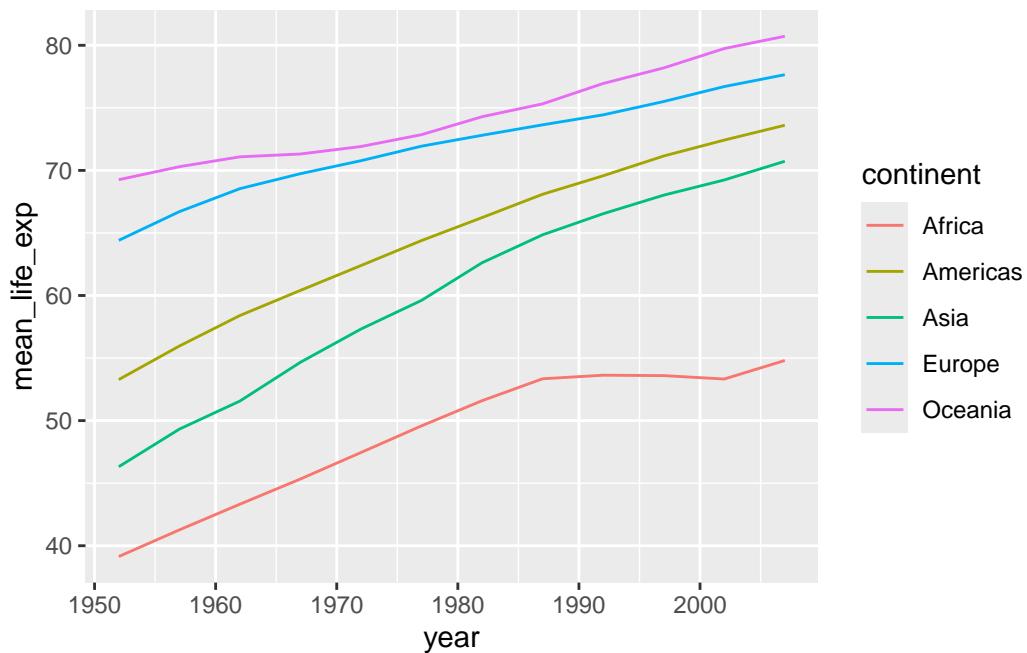
```
gapminder |>
  filter(continent == "Americas") |>
  ggplot() +
  geom_line(aes(x = year,
                y = lifeExp,
                group = country))
```



## 7.15 Exercise

Compute the average life expectancy for each continent for each year, and then create a line plot of the average life expectancy for each continent over time (each continent should have its own different colored line).

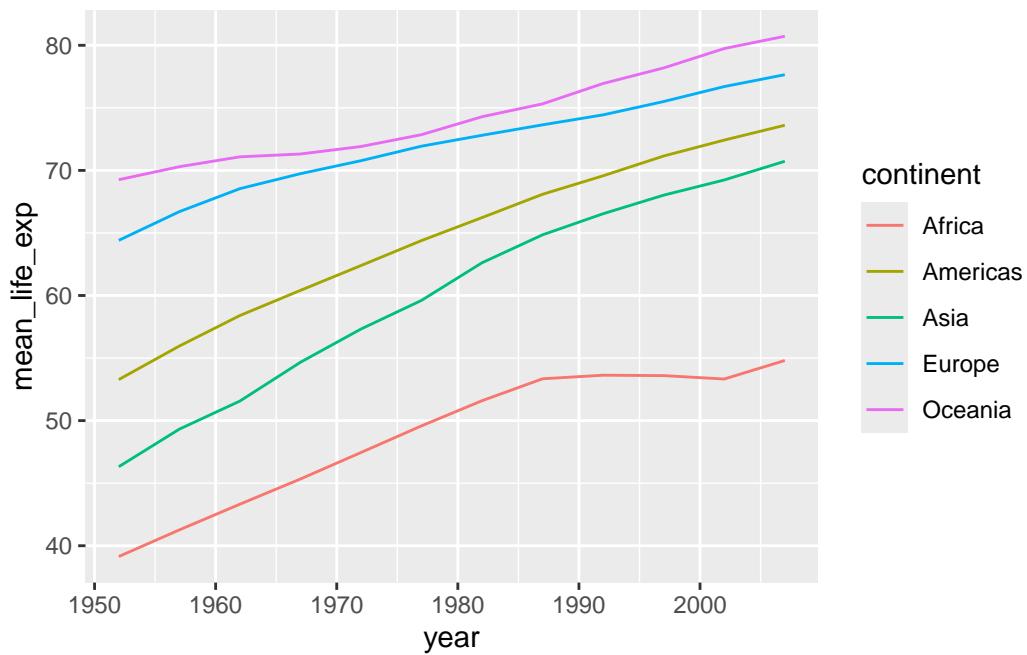
Here is an example of the plot I want you to make:



## 7.16 Solution

```
gapminder |>
  group_by(continent, year) |>
  summarize(mean_life_exp = mean(lifeExp)) |>
  ggplot() +
  geom_line(aes(x = year,
                y = mean_life_exp,
                color = continent))
```

``summarise()` has grouped output by 'continent'. You can override using the  
.groups` argument.`

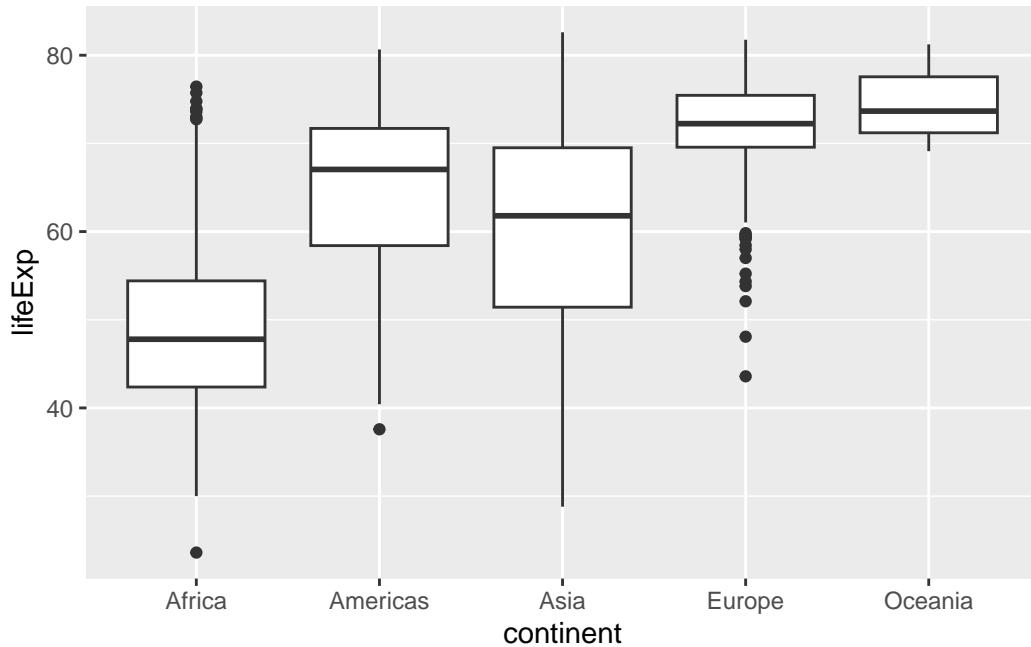


### 7.16.1 Boxplots

Like scatterplots created with `geom_point()`, boxplots created with a `geom_boxplot()` layer desire an `x` and a `y` aesthetic, however, unlike `geom_point()` which wants both the `x` and `y` variables to be continuous numeric variables, `geom_boxplot()` wants *one* of the `x` and `y` aesthetics to be a categorical (character or factor) variable and the other one to be numeric and `geom_boxplot()` will create a separate boxplot for each categorical value.

For example, below we create a boxplot of `lifeExp` for each `continent`:

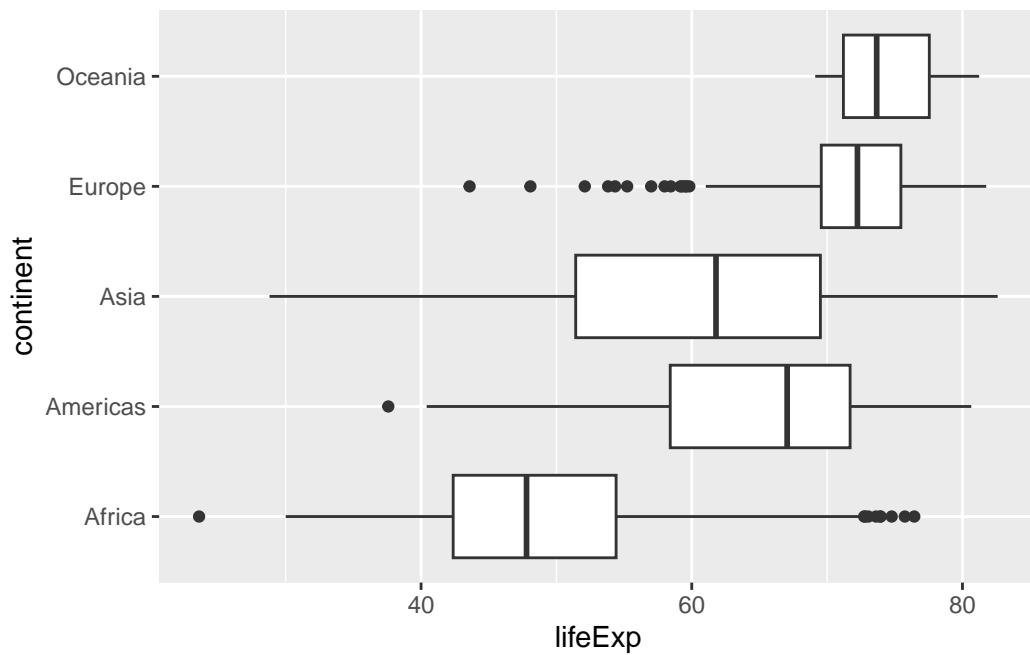
```
ggplot(gapminder) +
  geom_boxplot(aes(x = continent, y = lifeExp))
```



The bottom of the box part of a boxplot corresponds to  $Q_1$ , the first quartile of the variable (the value for which 25% of values are less than it) and the top of the box corresponds to the third quartile,  $Q_3$  of the variable (the value for which 75% of values are less than it). The bar in the middle is the median, which corresponds to the second quartile,  $Q_2$  (the value for which 50% of values are less than it). The lines that extend from the bottom and top of the boxplot reach as far as  $Q_1 - 1.5(Q_3 - Q_1)$  and  $Q_3 + 1.5(Q_3 - Q_1)$ , respectively, and all values that are outside this range are shown as points and are called “outliers.”

If you switch the x and the y so the y aesthetic is the categorical/character `continent` variable, then you get horizontal boxplots instead.

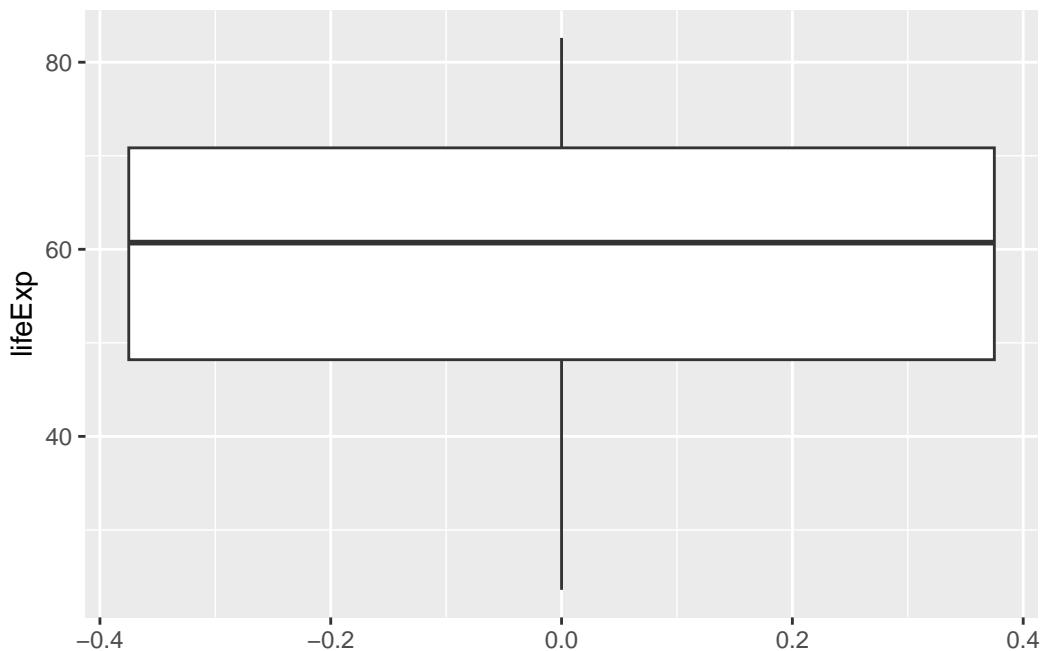
```
ggplot(gapminder) +
  geom_boxplot(aes(x = lifeExp, y = continent))
```



`geom_boxplot()` is great for creating side-by-side boxplots for the different levels/values of a categorical variable.

But you can create single boxplots for an entire variable, such as `lifeExp`, by just providing `y = lifeExp` to your aesthetic function (leaving `x` out entirely):

```
ggplot(gapminder) +
  geom_boxplot(aes(y = lifeExp))
```



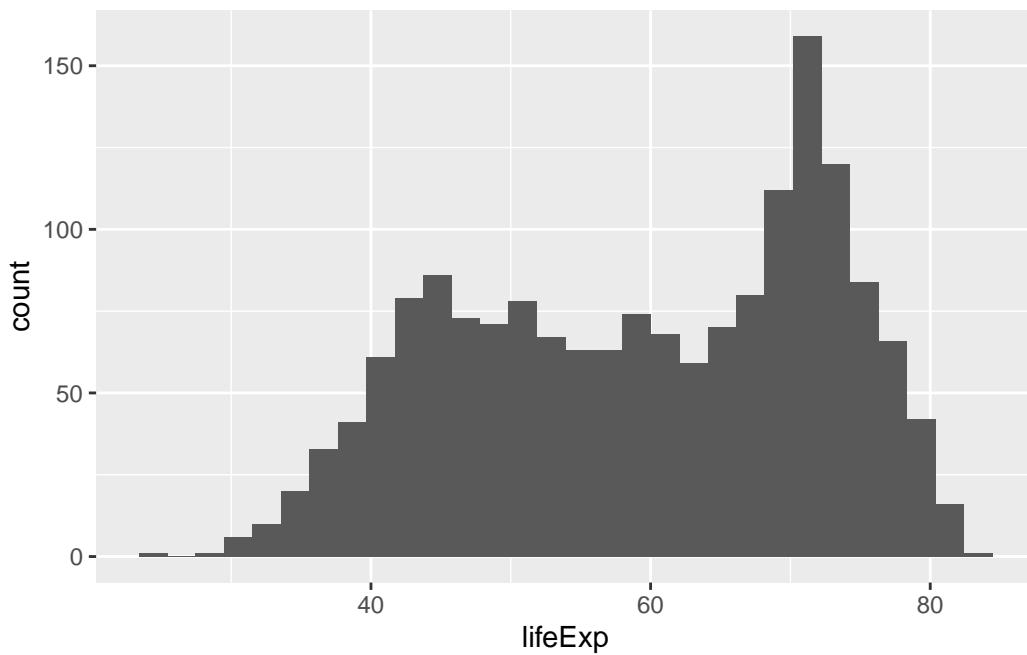
But I rarely do this—I find boxplots to be most helpful for *comparing* the distributions of a variable across different groups.

### 7.16.2 Histograms

If I want to look at the distribution of a single variable, I find it more useful to use a histogram, such as the histogram of `lifeExp` below:

```
ggplot(gapminder) +  
  geom_histogram(aes(x = lifeExp))
```

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

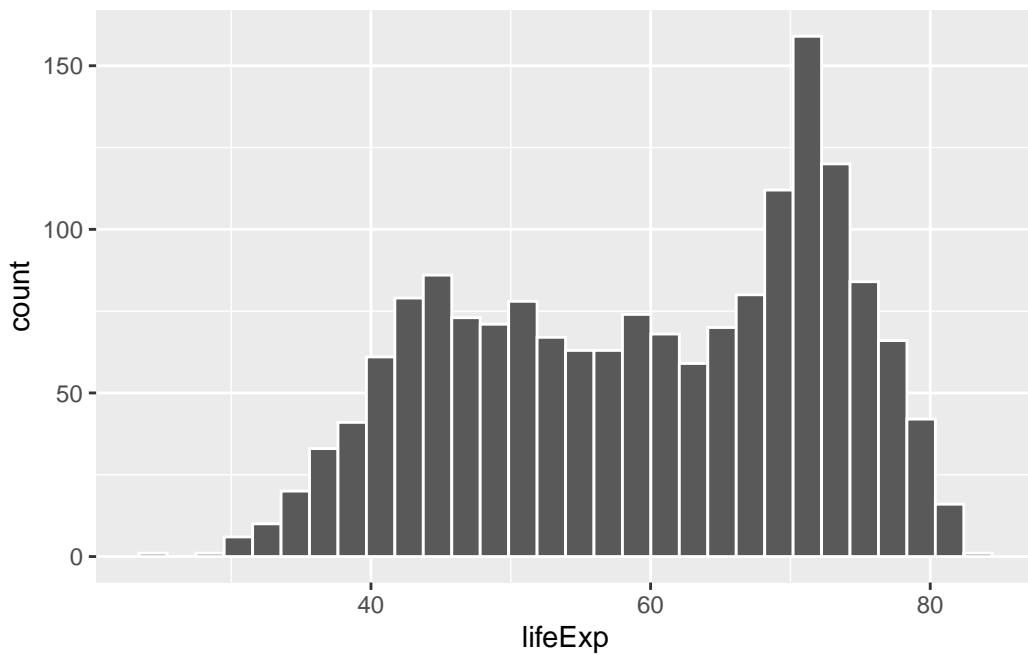


A histogram essentially takes the range of a continuous numeric variable, chops it up into binned intervals, and then uses bars to represent how many values fall into each binned interval.

I don't like that the histogram doesn't provide outlines for each of the bars, so I often add them in by providing a `color` value *outside* the `aes()` function in my `geom_histogram()` function:

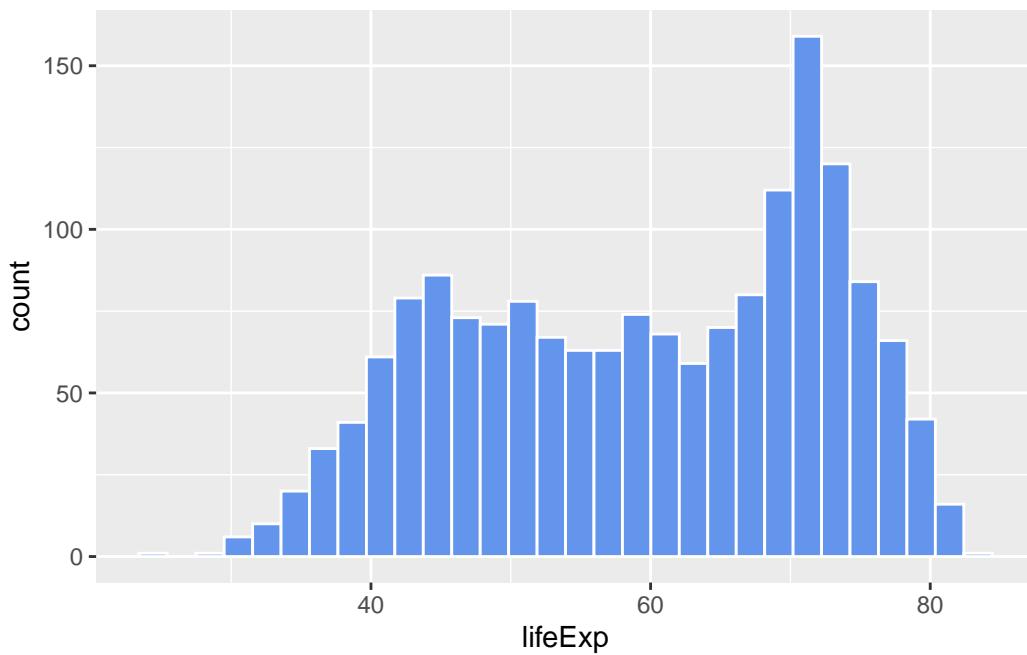
```
ggplot(gapminder) +  
  geom_histogram(aes(x = lifeExp),  
                 color = "white")
```

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



Notice that `color` here refers to the *outline* of the bars, rather than the bars themselves. If you want the bars themselves to have a different color, you need to use the `fill` aesthetic.

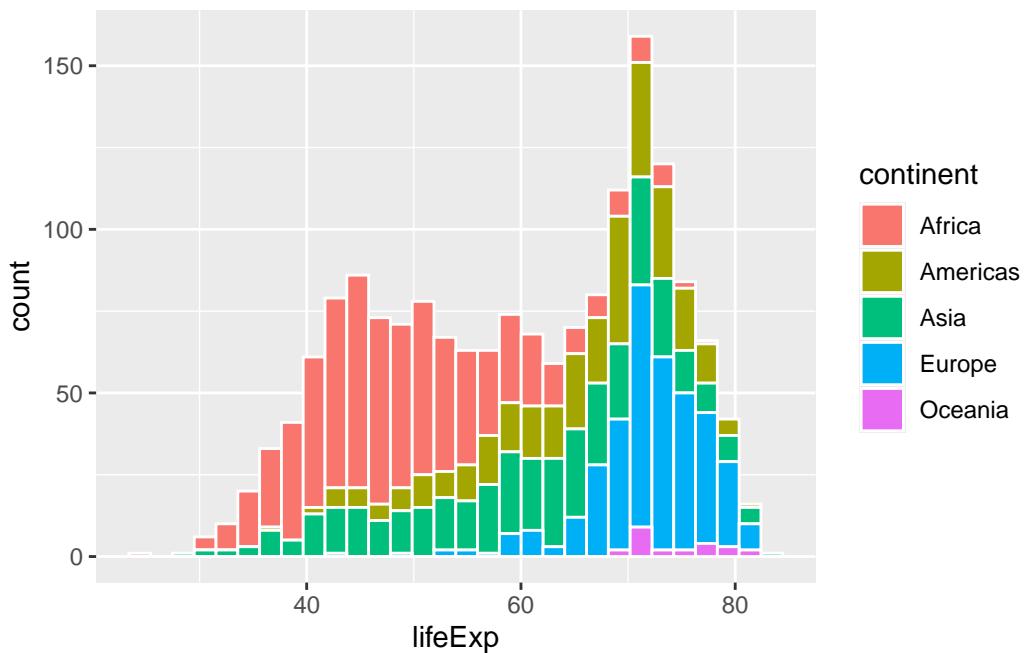
```
ggplot(gapminder) +  
  geom_histogram(aes(x = lifeExp),  
                 color = "white",  
                 fill = "cornflowerblue")  
  
`stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



You can also provide a `fill` to your histogram where the bars are colored using a categorical variable, such as `continent`:

```
ggplot(gapminder) +  
  geom_histogram(aes(x = lifeExp,  
                     fill = continent),  
                 color = "white")
```

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

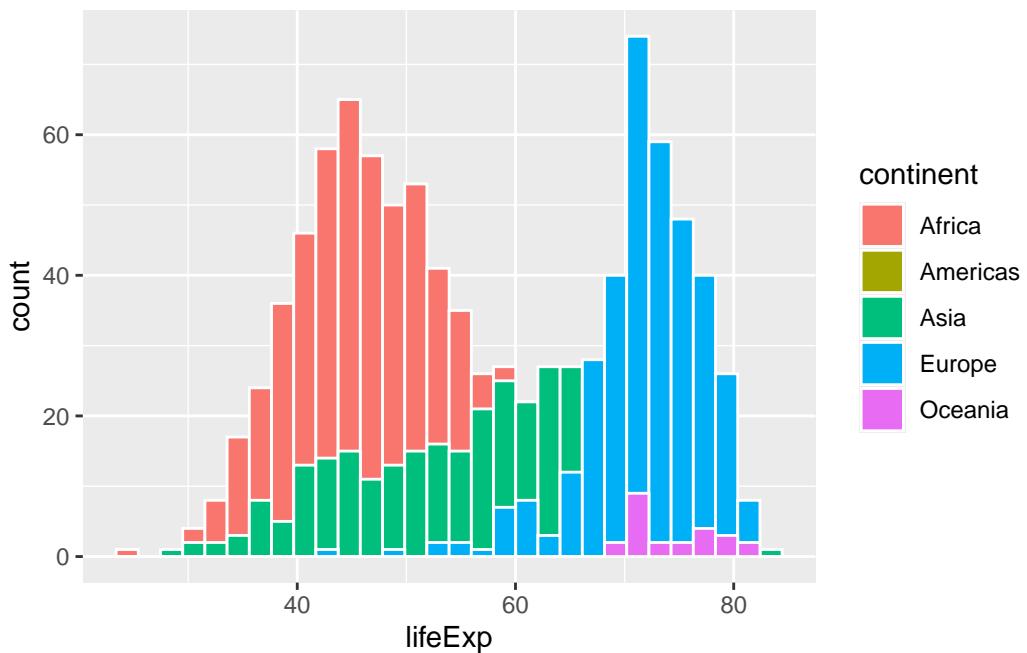


But be warned that these bars are “*stacked*” on top of one another, so the overall shape is the same as that of the entire variable in the histogram above.

If you want to *compare* the distributions of the `lifeExp` variable across each continent where each continent’s histogram starts from 0, you need to specify an additional argument to `geom_histogram()`, which is `position = "identity"`.

```
ggplot(gapminder) +
  geom_histogram(aes(x = lifeExp,
                     fill = continent),
                 color = "white",
                 position = "identity")
```

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

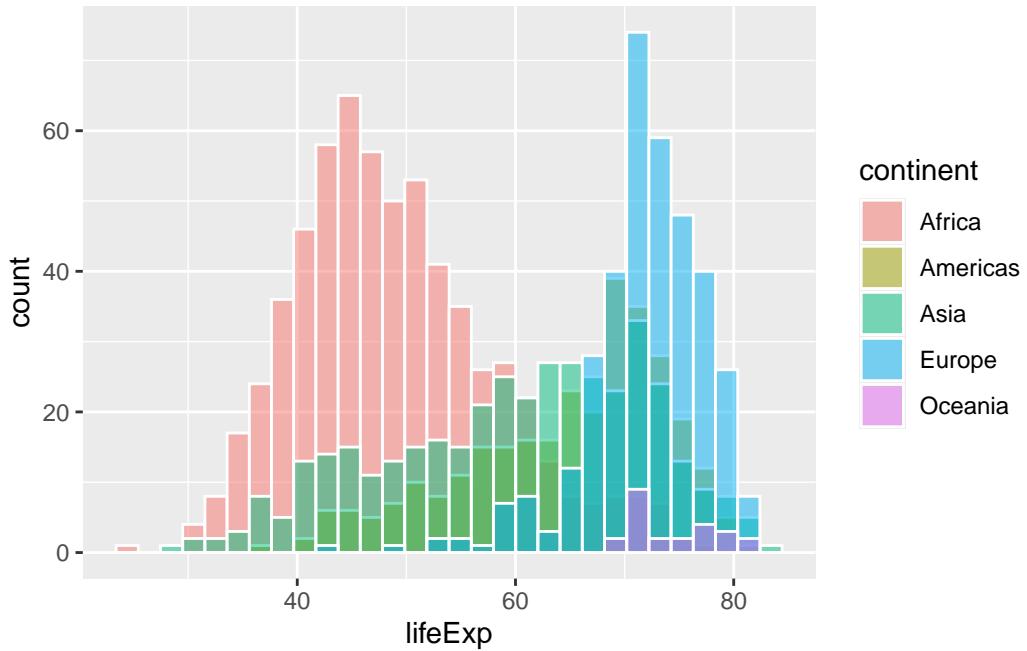


Now each continent's histograms start at  $y = 0$ , but because they are opaque, it's hard to properly see how the distributions overlap.

This is another place where transparency comes in handy! If we set `alpha = 0.5`, it becomes slightly easier to see how the distributions overlap.

```
ggplot(gapminder) +
  geom_histogram(aes(x = lifeExp,
                     fill = continent),
                 color = "white",
                 position = "identity",
                 alpha = 0.5)
```

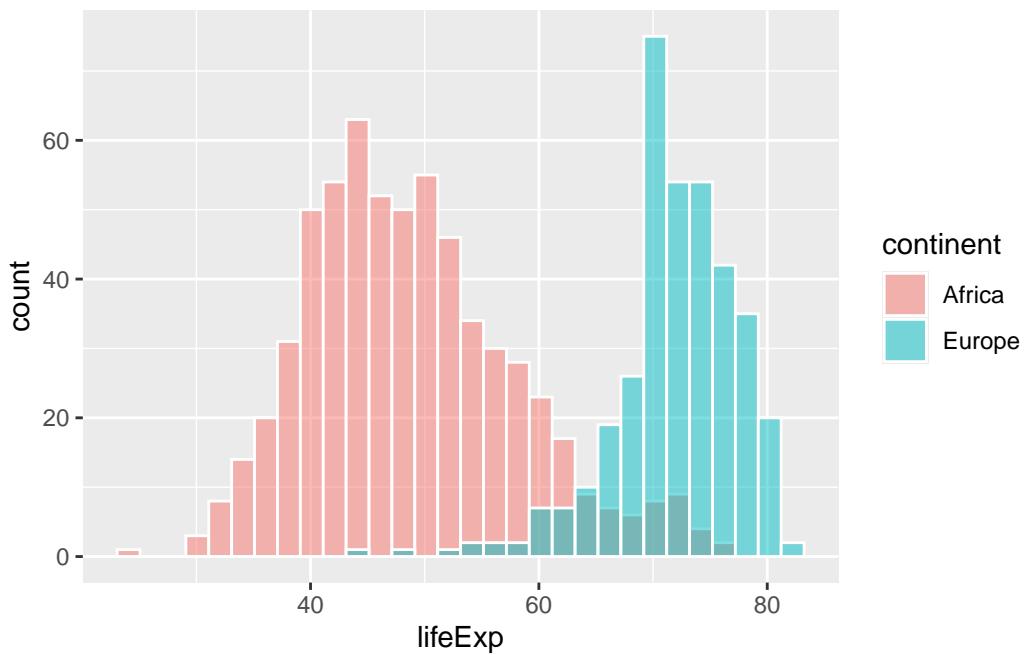
``stat_bin()` using `bins = 30``. Pick better value with ``binwidth``.



This plot is a bit busy though, so it might be a bit easier to just compare two groups, such as “Europe” and “Africa”:

```
gapminder |>
  filter(continent %in% c("Europe", "Africa")) |>
  ggplot() +
  geom_histogram(aes(x = lifeExp,
                     fill = continent),
                 color = "white",
                 position = "identity",
                 alpha = 0.5)
```

`stat\_bin()` using `bins = 30`. Pick better value with `binwidth`.

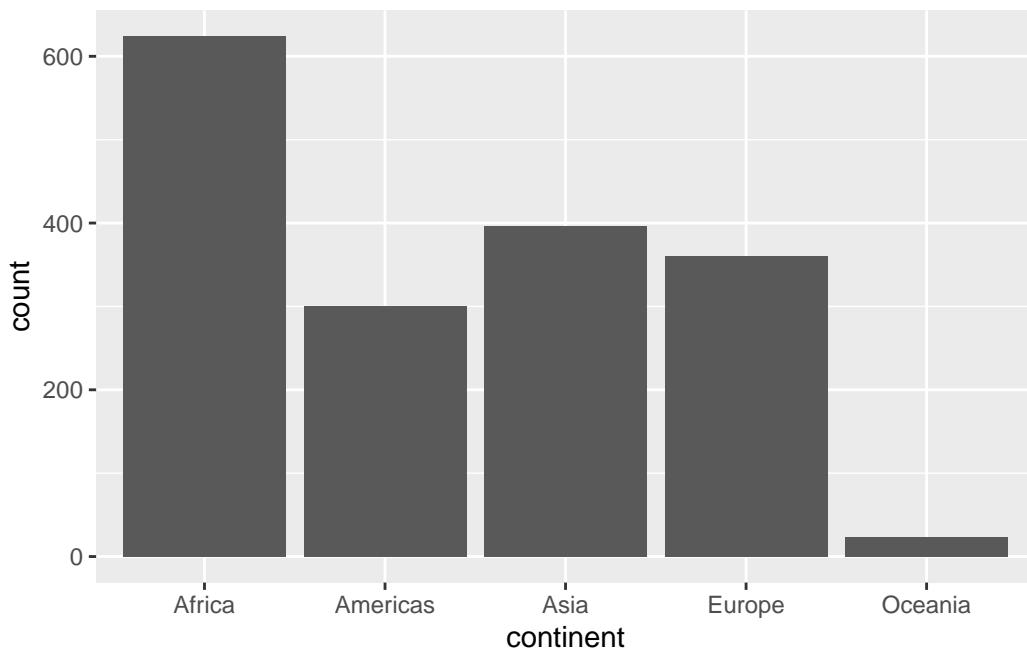


### 7.16.3 Bar charts

A bar chart is like a histogram, but for categorical variables instead of continuous numeric ones.

You can create a *count* bar chart, by providing a categorical (character/factor) variable as your x-aesthetic to `geom_bar()`, which will then add up how many times each value of the categorical variable appears and use this as the height of the bars:

```
# create a bar chart of the continent *counts*
ggplot(gapminder) +
  geom_bar(aes(x = continent))
```



So the "Africa" continent appears over 600 times in the data, while the "Asia" appears around 400 times.

If you want to create bar charts in which you manually specify the height of each bar based on a variable in your data, you want to use `geom_col()` instead of `geom_bar()`.

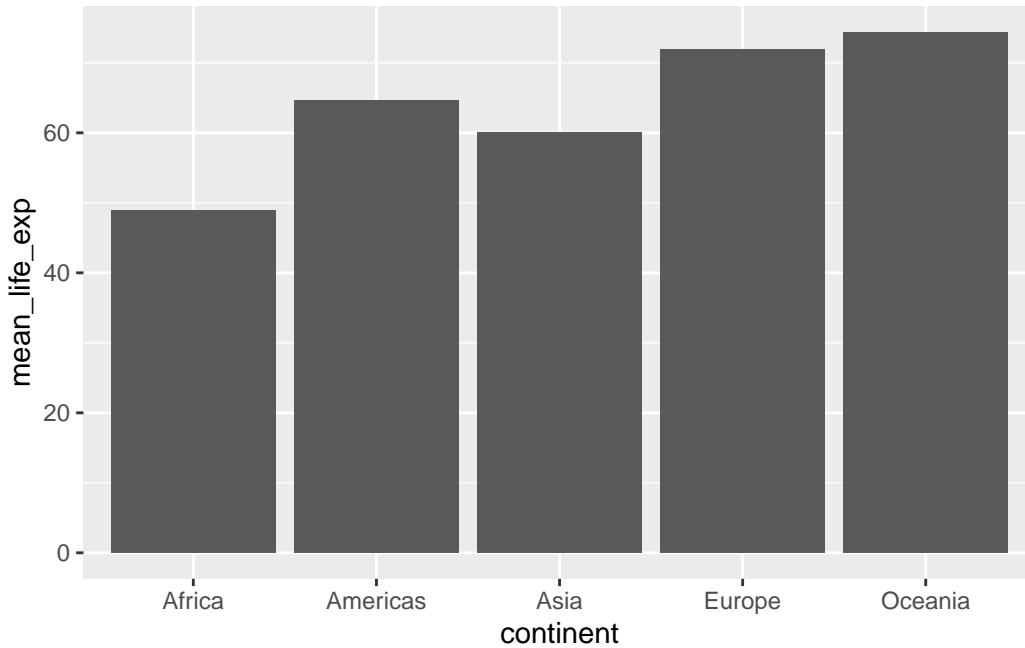
For example, below, I create a bar chart that shows the *average life expectancy* for each continent, first you have to calculate the average life expectancy for each continent (I save the resulting data frame as a new variable, `mean_life_exp_df`):

```
mean_life_exp_df <- gapminder |>
  group_by(continent) |>
  summarize(mean_life_exp = mean(lifeExp))
mean_life_exp_df
```

```
# A tibble: 5 x 2
  continent mean_life_exp
  <chr>        <dbl>
1 Africa         48.9
2 Americas       64.7
3 Asia           60.1
4 Europe         71.9
5 Oceania        74.3
```

And then I can use ggplot with a `geom_col()` layer that has `x = continent` as the x-aesthetic (which will be used to determine how many bars there are and their names), and my calculated `y = mean_life_exp` as the height aesthetic.

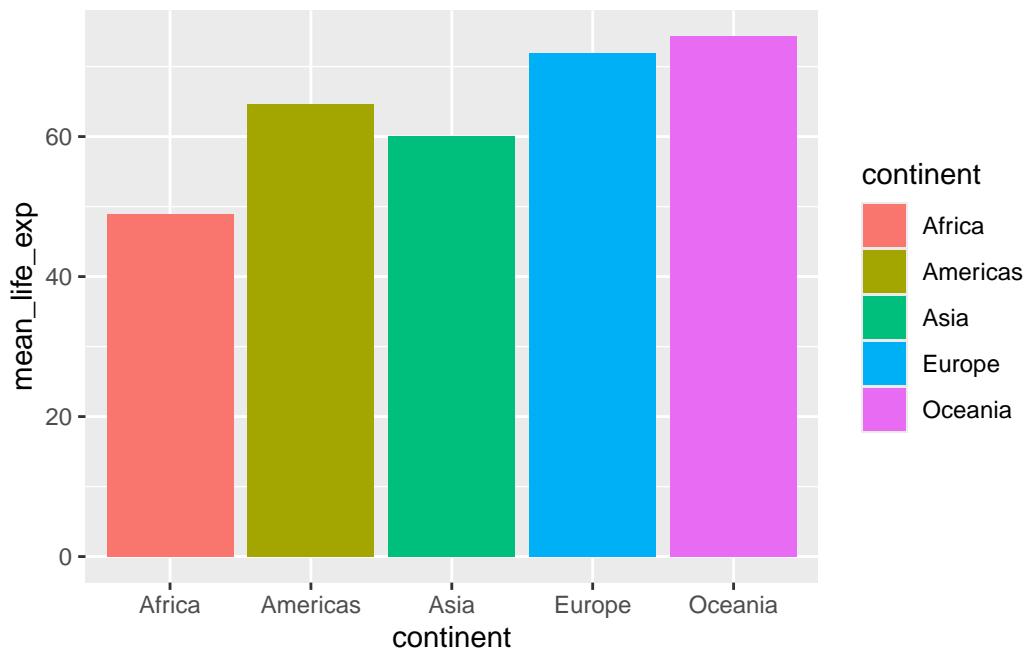
```
ggplot(mean_life_exp_df) +  
  geom_col(aes(x = continent,  
               y = mean_life_exp))
```



Like histograms, you can color your bars using the `fill` aesthetic.

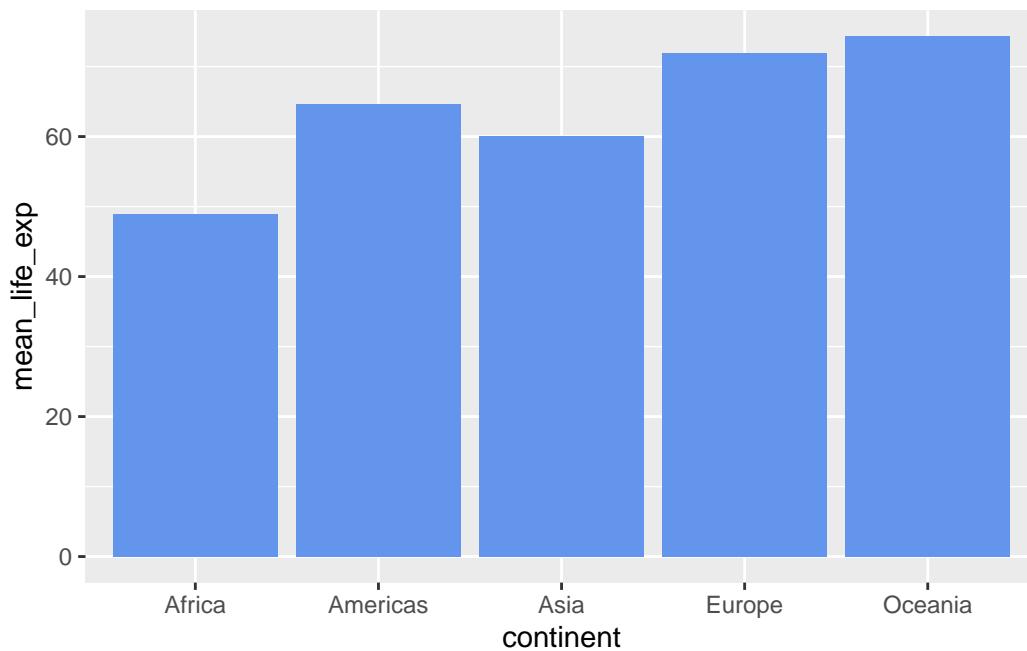
To give each bar/continent a different color, provide `fill = continent` *inside* the `aes()` function:

```
ggplot(mean_life_exp_df) +  
  geom_col(aes(x = continent,  
               y = mean_life_exp,  
               fill = continent))
```



And to give each bar the same global color, provide your color to `fill outside` the `aes()` function (pay close attention to the closing parentheses and indentation):

```
ggplot(mean_life_exp_df) +  
  geom_col(aes(x = continent,  
               y = mean_life_exp),  
           fill = "cornflowerblue")
```



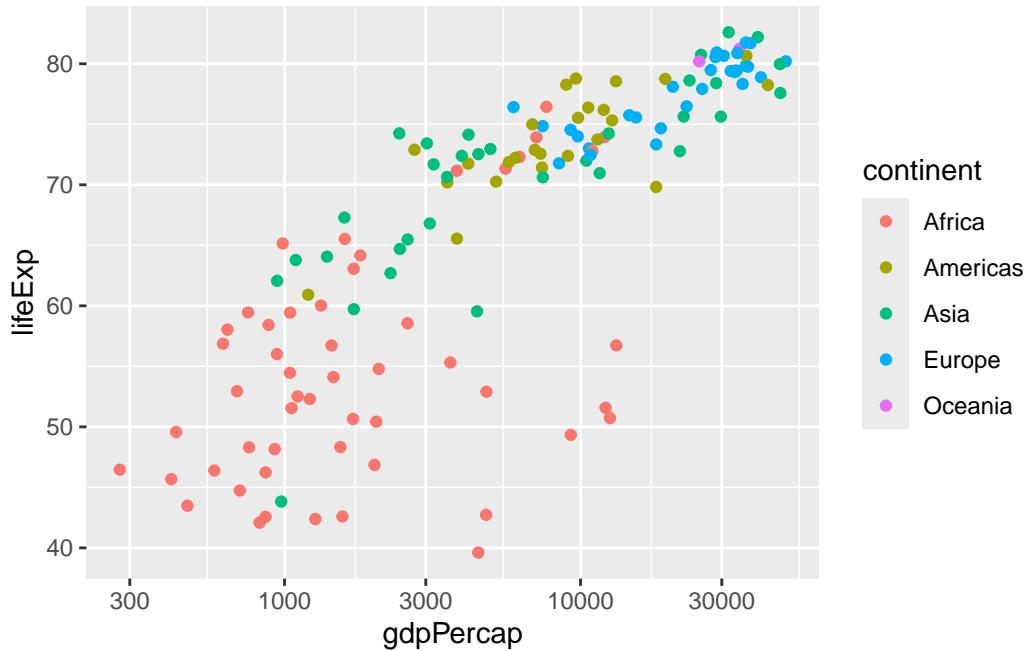
## 7.17 Getting fancy with ggplot2

Now that you've seen the most common ggplot2 "geom" layers I typically use, let's talk about how to do even fancier things with ggplot2.

### 7.17.1 Transformations

You can apply log-scale transformations to your axis by adding a scale layer. Below, the layer `scale_x_log10()` converts the x-axis to a  $\log_{10}$  scale, so each break increases by an order of magnitude rather than by a fixed amount.

```
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPercap,  
                 y = lifeExp,  
                 color = continent)) +  
  scale_x_log10()
```



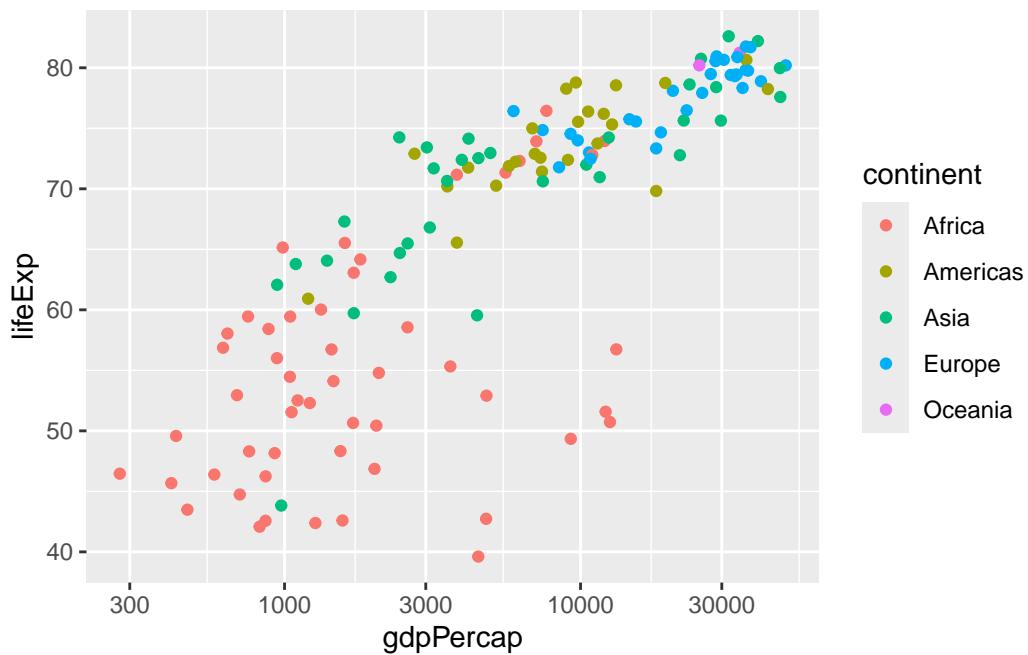
Because I want to keep using this plot as I show you more cool things, I'm going to save it as a variable!

I can do this by assigning it to a new variable name like this:

```
life_gdp_scatter <- ggplot(gapminder_2007) +
  geom_point(aes(x = gdpPercap,
                 y = lifeExp,
                 color = continent)) +
  scale_x_log10()
```

As usual, when I define a variable, no output is shown, but I can look at the object contained in this variable by typing its name:

```
life_gdp_scatter
```



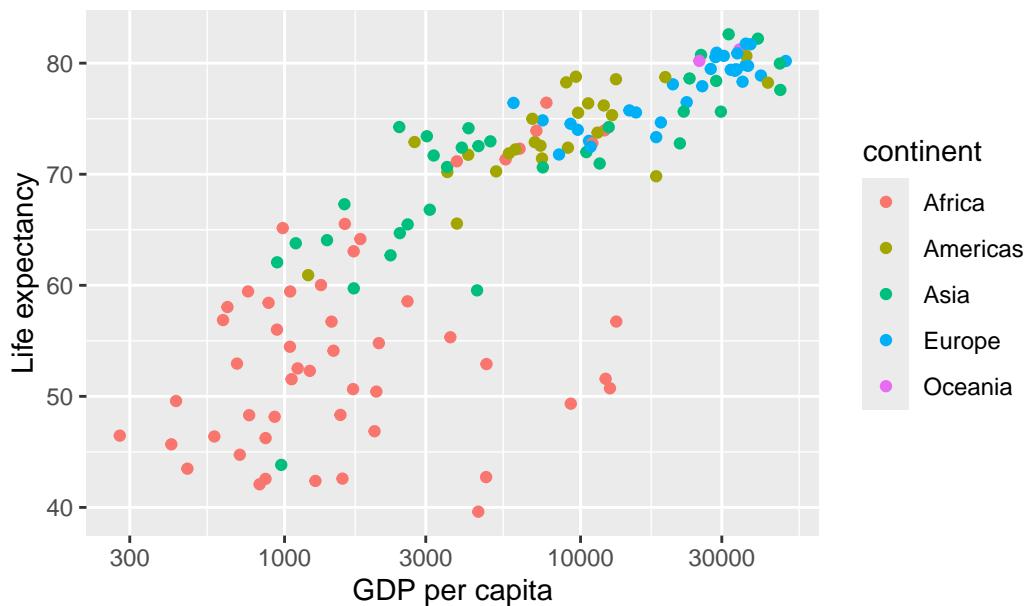
And the super neat thing is that because this is just a ggplot object, I can keep adding things to it using `+`!

### 7.17.2 Labels

You can clean the labels of your figure by adding a `labs()` layer.

```
life_gdp_scatter +
  labs(x = "GDP per capita",
       y = "Life expectancy",
       title = "GDP per cap vs life expectancy")
```

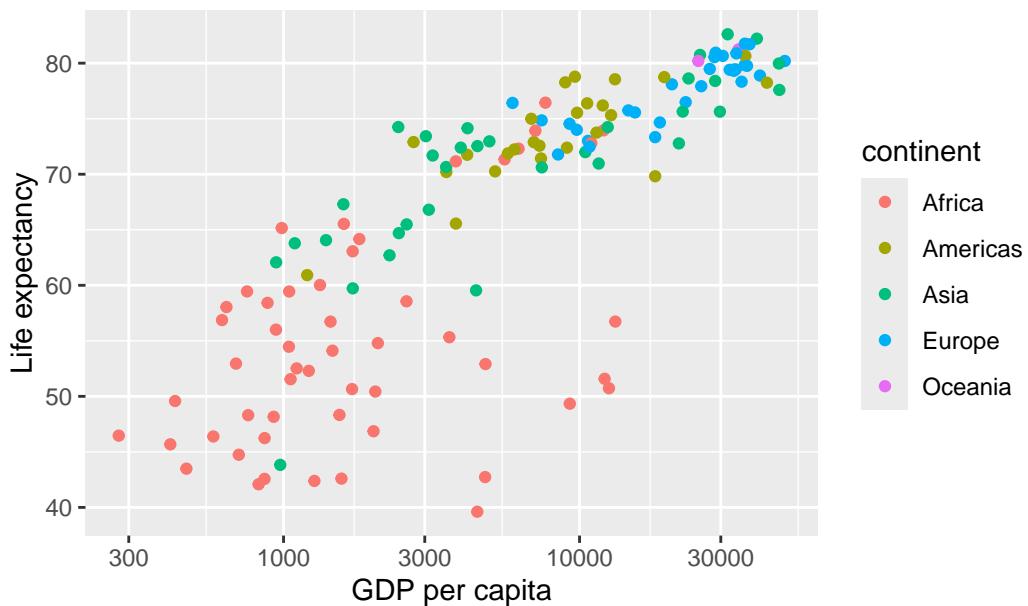
## GDP per cap vs life expectancy



This is equivalent to replacing `life_gdp_scatter` with the code that was used to define it:

```
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPercap,  
                 y = lifeExp,  
                 color = continent)) +  
  scale_x_log10() +  
  labs(x = "GDP per capita",  
       y = "Life expectancy",  
       title = "GDP per cap vs life expectancy")
```

## GDP per cap vs life expectancy



And I'm going to update my scatterplot object to contain these new labels by overwriting my `life_gdp_scatter` object with the old one plus the labels layer:

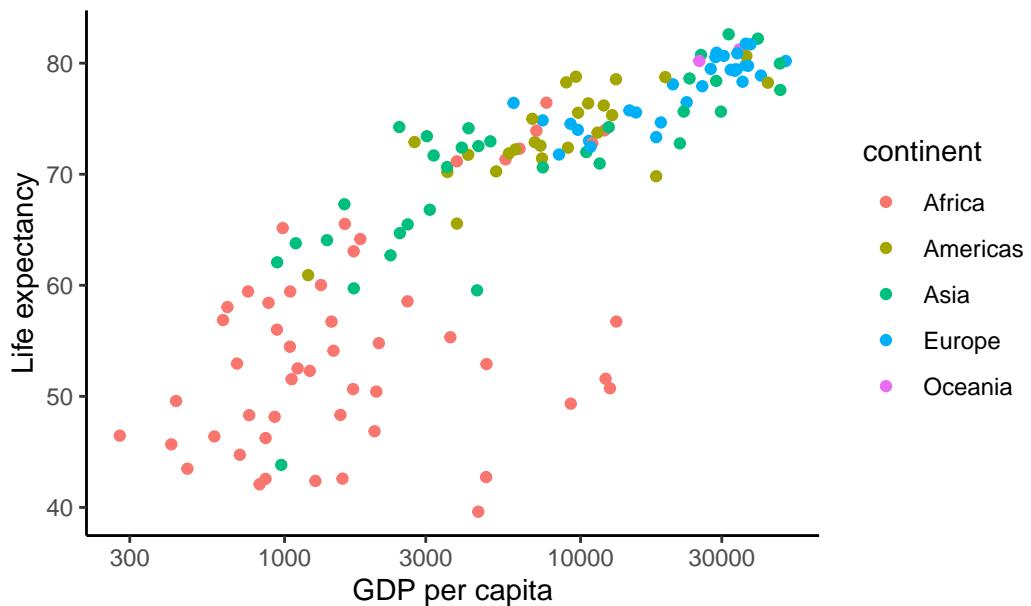
```
life_gdp_scatter <- life_gdp_scatter +  
  labs(x = "GDP per capita",  
        y = "Life expectancy",  
        title = "GDP per cap vs life expectancy")
```

### 7.17.3 Themes

Next, I want to give my figure a theme by adding a themes layer. There are a lot of theme options. My favorite is `theme_classic()`:

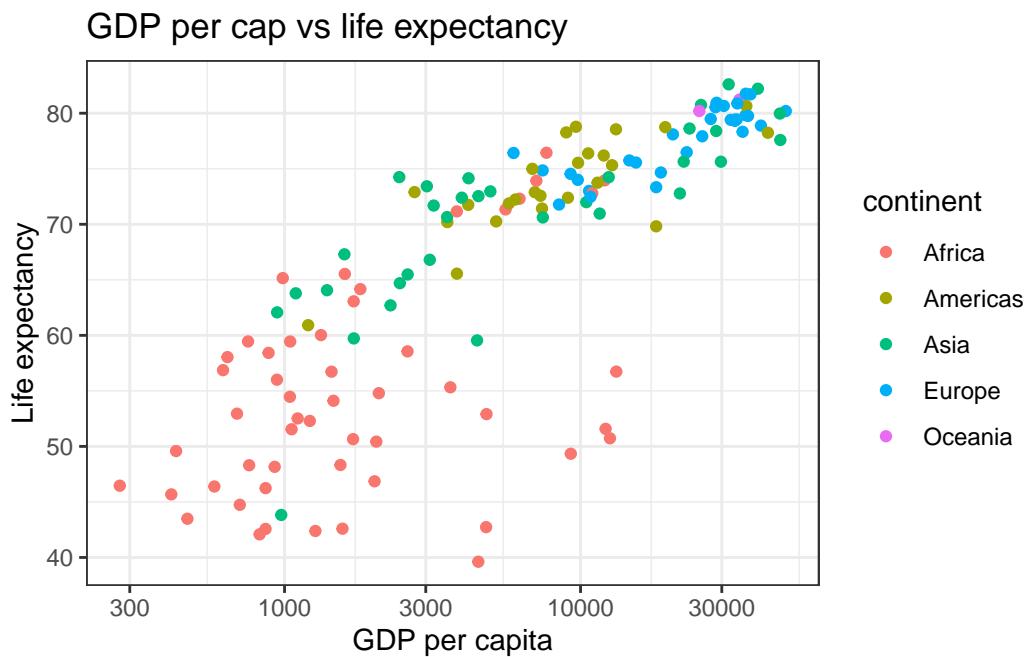
```
life_gdp_scatter + theme_classic()
```

GDP per cap vs life expectancy



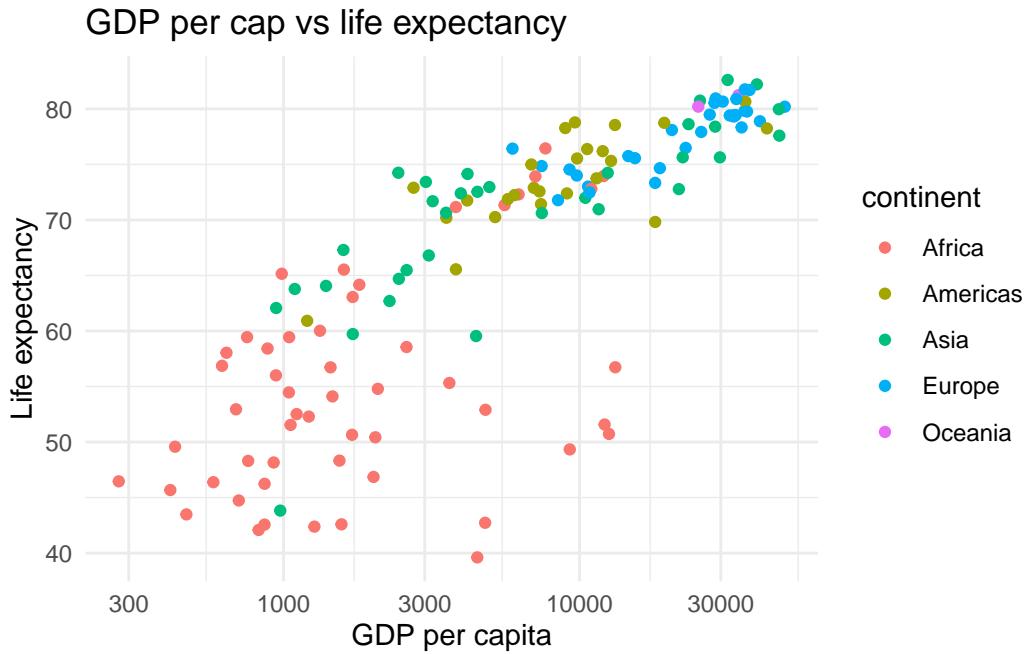
Another popular one is `theme_bw()`:

```
life_gdp_scatter + theme_bw()
```



and `theme_minimal()`:

```
life_gdp_scatter + theme_minimal()
```



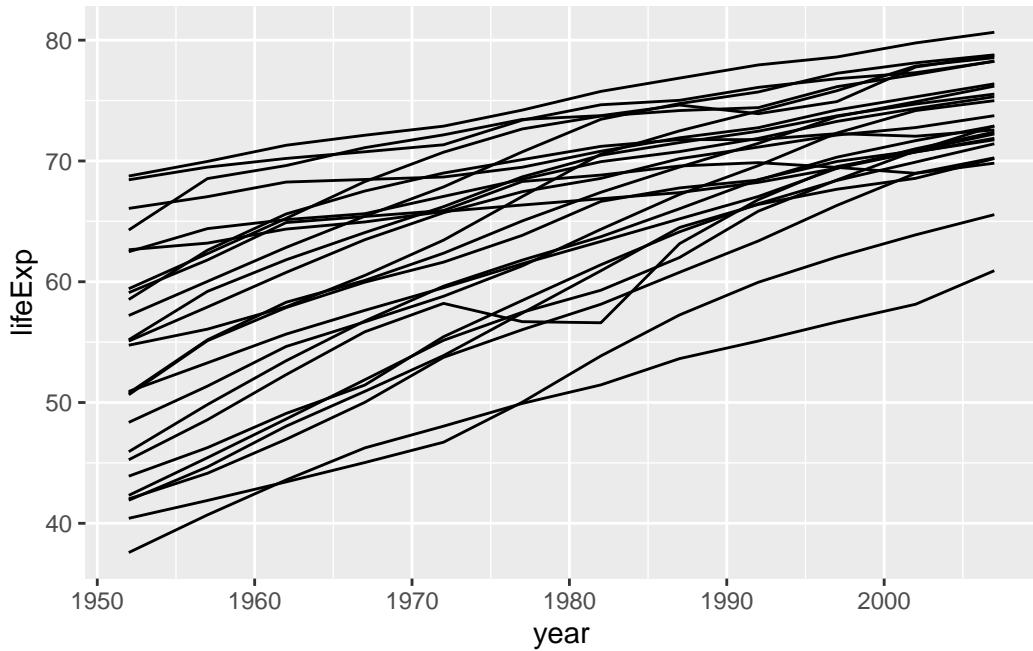
But there are lots of others too.

#### 7.17.4 Faceted grids

The last neat ggplot2 thing I want to show you is how to create a grid of plots using `facet_wrap()`.

If I have a bunch of line plots on the same plot like this:

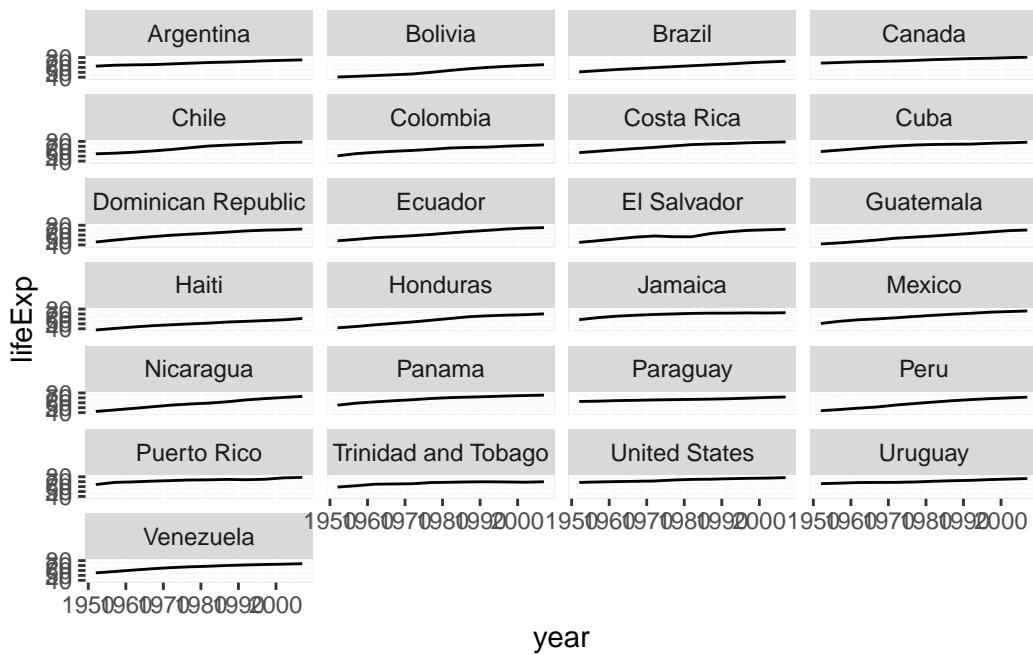
```
gapminder |>
  filter(continent == "Americas") |>
  ggplot() +
  geom_line(aes(x = year,
                y = lifeExp,
                group = country))
```



I might find myself wishing that I had a separate plot for each country, but I don't want to actually write the code to create a separate line plot for each country manually.

Fortunately, `facet_wrap()` (and `facet_grid()`) can do this for me. Below I take the same code and add a `facet_wrap()` layer where I specify which categorical variable in my data I want to use to specify the different plot panels (I write `~country` to create a separate panel for each value in `country`). This is essentially just taking each line in the plot above and giving it its own plot. Each plot will inherit the aesthetic properties of the `geom_line()` layer. Note that the `ncol = 4` argument of `facet_wrap()` tells ggplot2 that I want my plot grid to have 4 columns.

```
gapminder |>
  filter(continent == "Americas") |>
  ggplot() +
  geom_line(aes(x = year,
                y = lifeExp)) +
  facet_wrap(~country, ncol = 4)
```

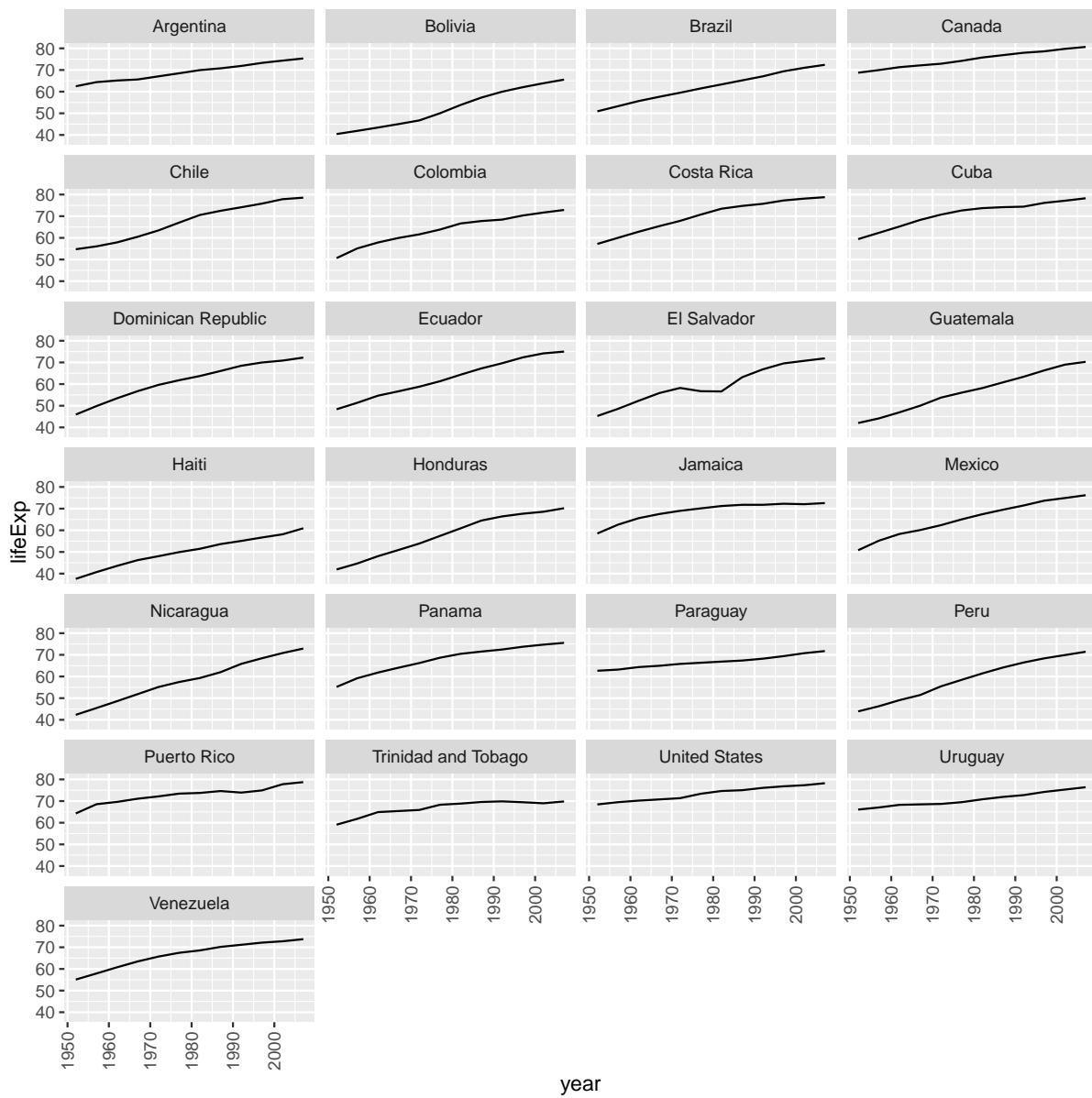


### 7.17.5 Controlling figure output size in quarto

My previous plot is all cramped, but if I add some `#| fig-height: 8` and `#| fig-width: 8` options to the top of my quarto code chunk, I can control the size of the output in my rendered quarto document, such as

```
```{r}
#| fig-height: 8
#| fig-width: 8
gapminder |>
  filter(continent == "Americas") |>
  ggplot() +
  geom_line(aes(x = year,
                y = lifeExp)) +
  facet_wrap(~country, ncol = 4)
```

```



Note that I also rotated my x-axis text 90 degrees using a `theme()` layer. If you want to start truly customizing your ggplots, you're going to get intimately familiar with the `theme()` layer options.

## 7.18 Exercise

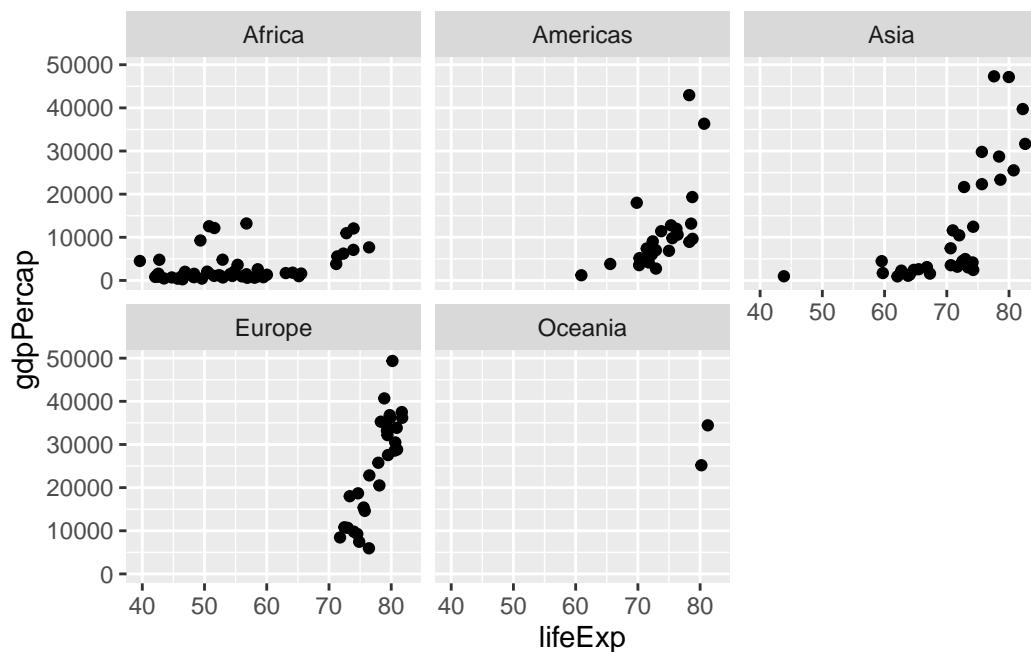
Create a faceted grid of scatterplots of `lifeExp` against `gdpPerCap` in 2007 for each continent (i.e., there is a separate panel for each continent). Do some fancy things to make your plot

sparkle!

## 7.19 Solution

Here is a plot without much fun:

```
gapminder_2007 |>
  ggplot() +
  geom_point(aes(x = lifeExp, y = gdpPerCap)) +
  facet_wrap(~continent)
```



Here is a plot with some fun:

```
gapminder_2007 |>
  ggplot() +
  geom_point(aes(x = lifeExp,
                 y = gdpPerCap,
                 size = pop,
                 color = continent),
             alpha = 0.5) +
  scale_x_log10() +
  scale_y_log10()
```

```
theme_minimal() +  
facet_wrap(~continent) +  
labs(x = "Life Expectancy",  
y = "GDP per Capita",  
size = "Population",  
color = "Continent")
```

