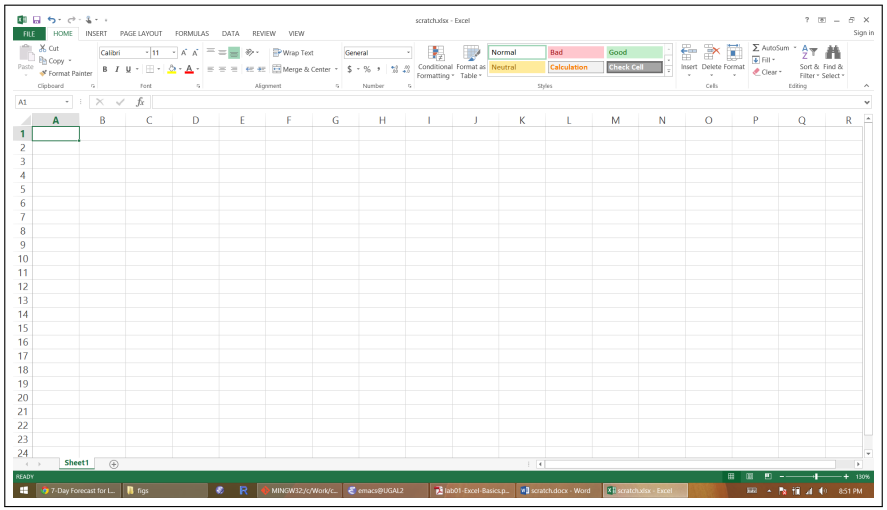
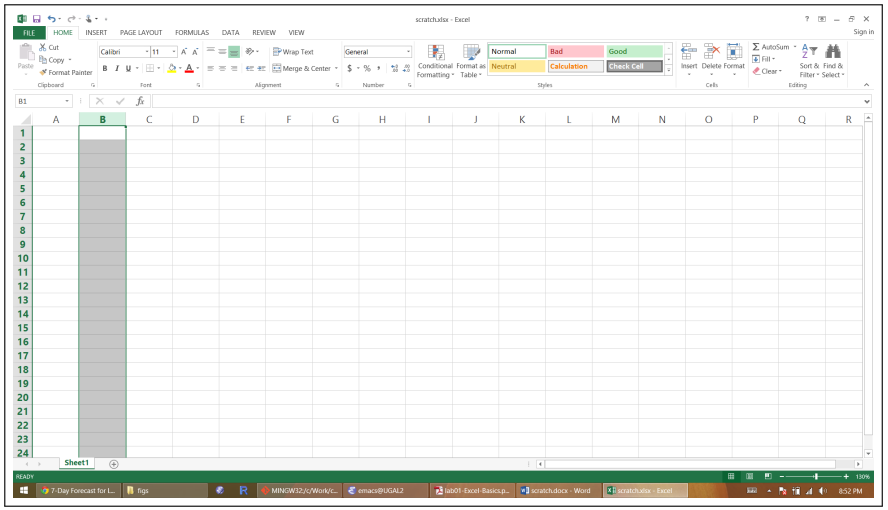
Applied Population Dynamics

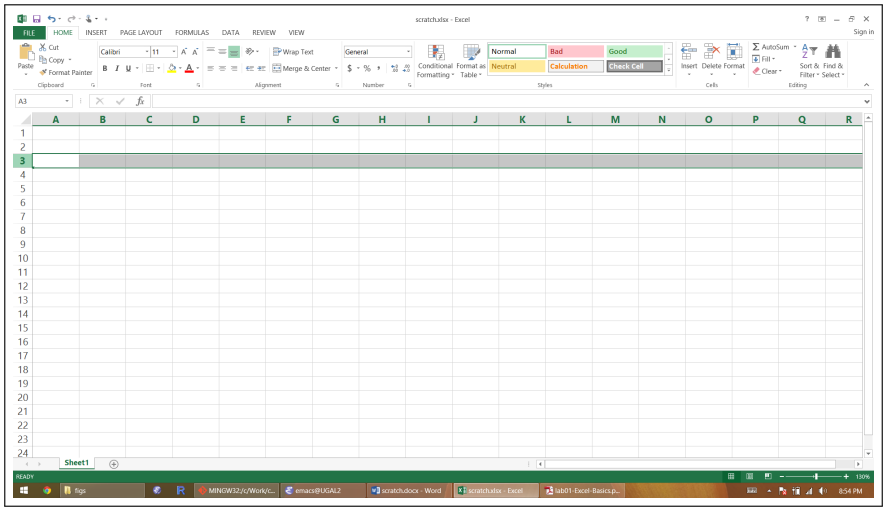
Lab 1 – Excel and R Basics



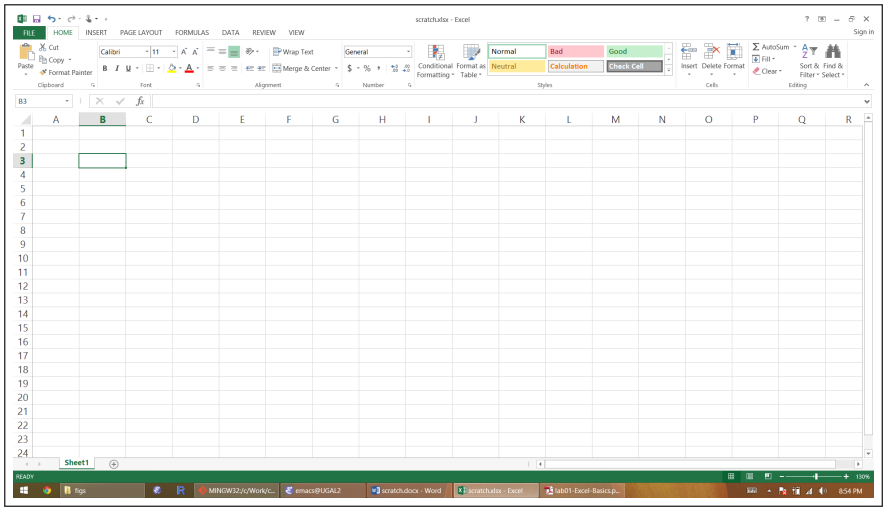
Column B



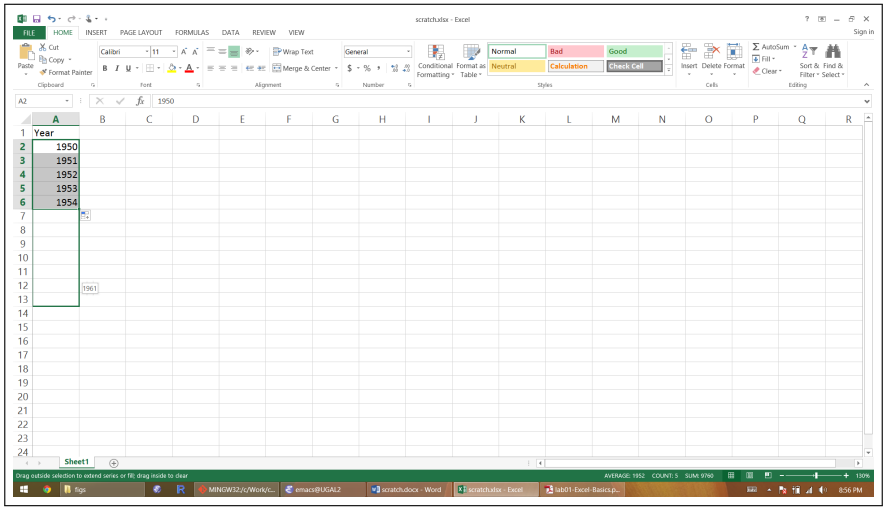
Row 3



Cell B3

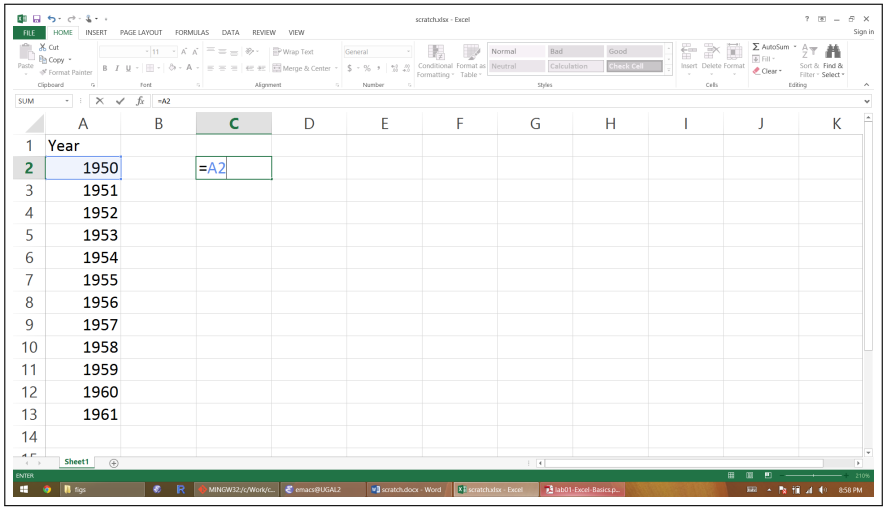


Create Sequence Using Auto-fill



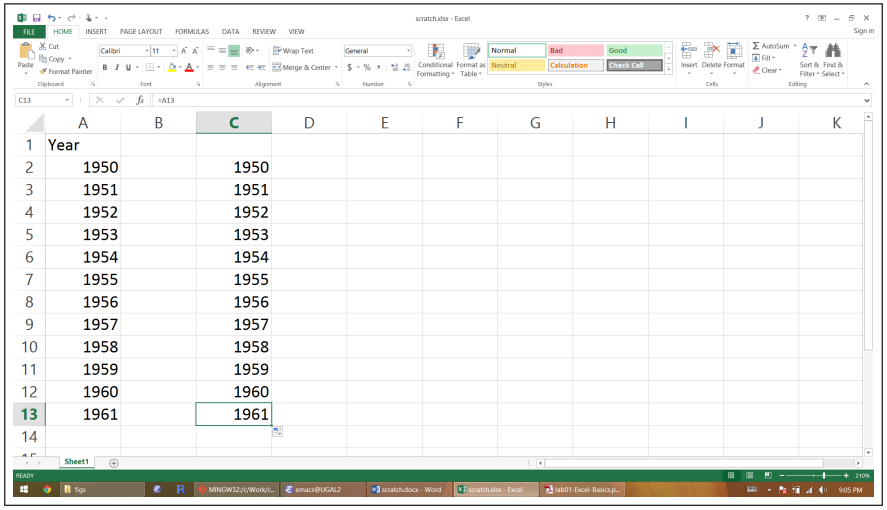
To use auto-fill: begin a sequence, highlight the cells, and then drag the box at the bottom-right of the last cell.

Relative Cell References



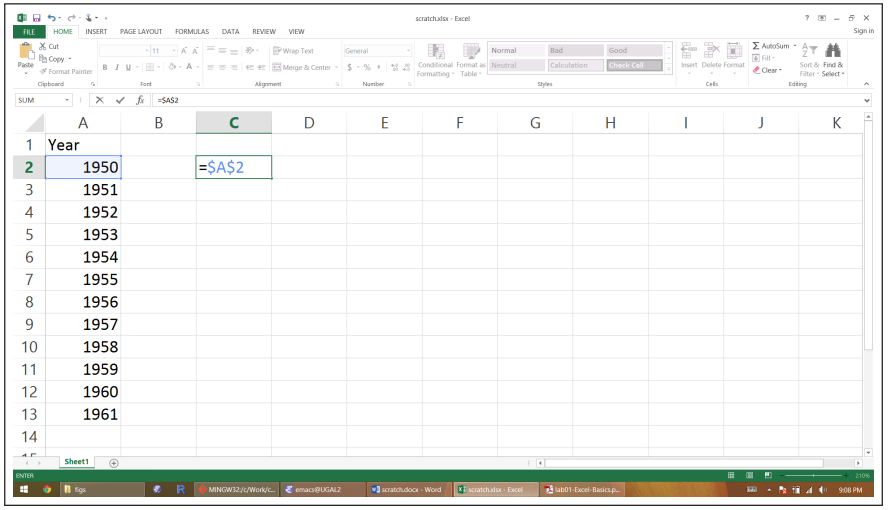
Cell C2 will take on the value of A2

Relative Cell References



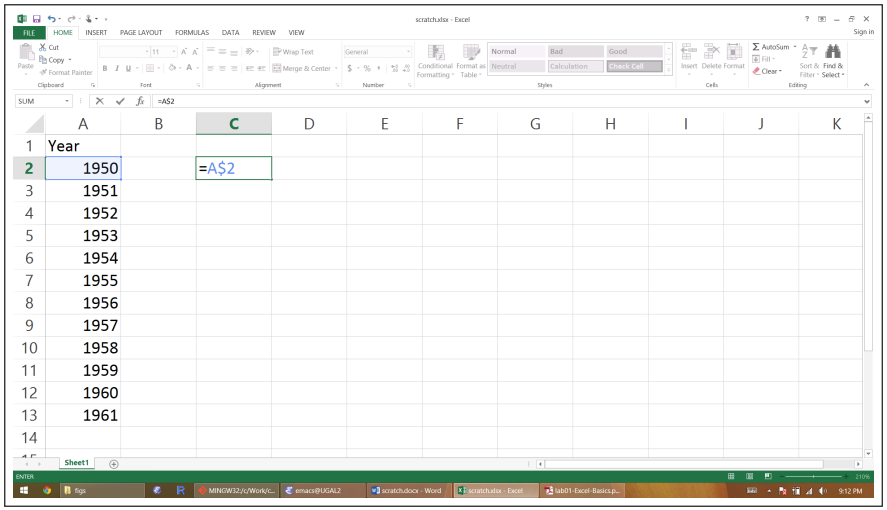
Values of reference will change when using auto-fill

Absolute Cell References

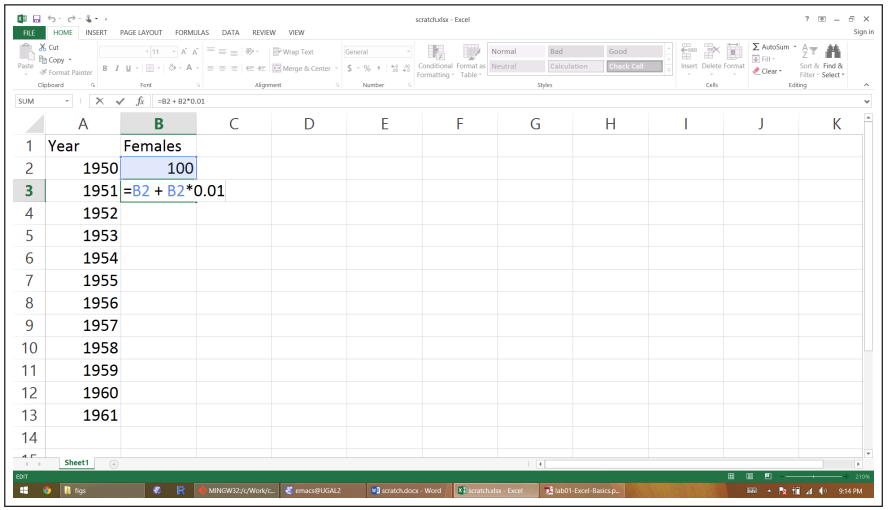


Dollar sign “locks” a reference so that auto-fill won’t change it

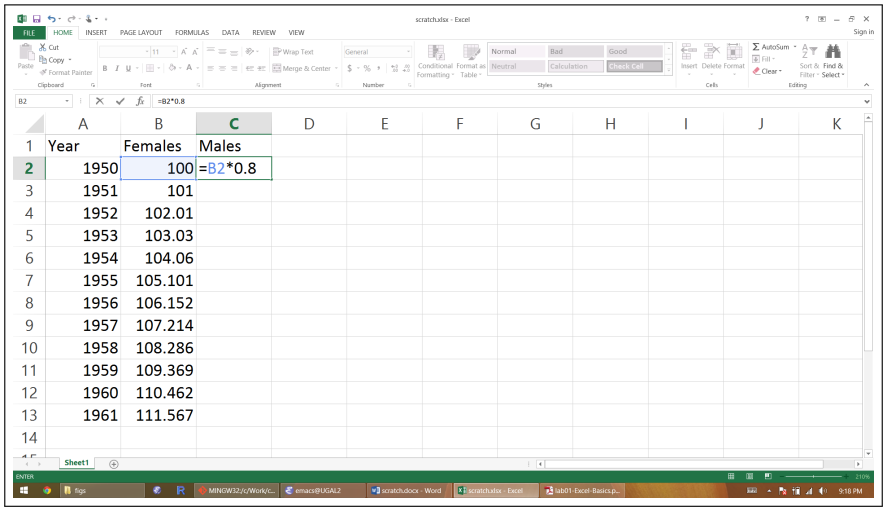
Partial Cell References



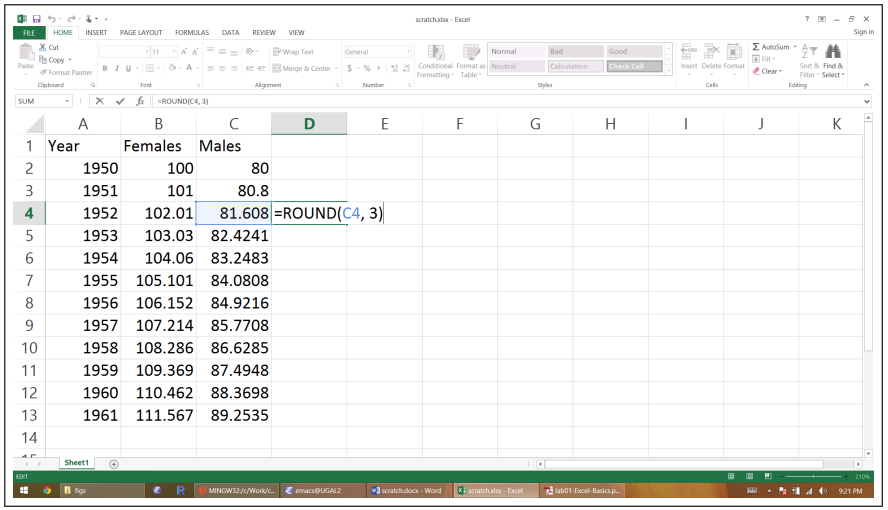
Equations



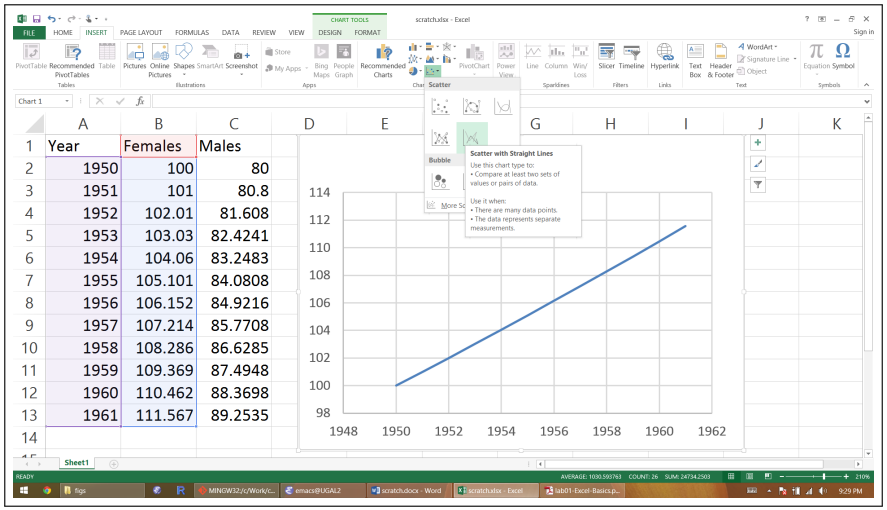
Equations



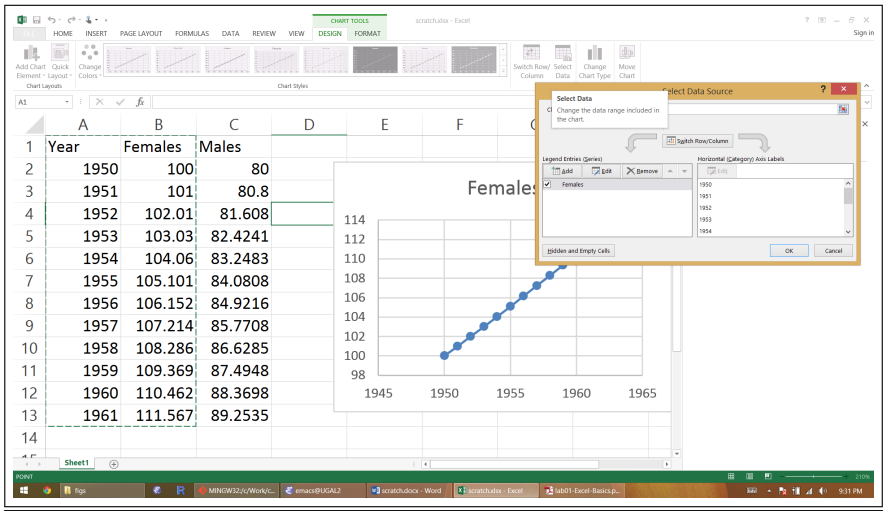
Formulas

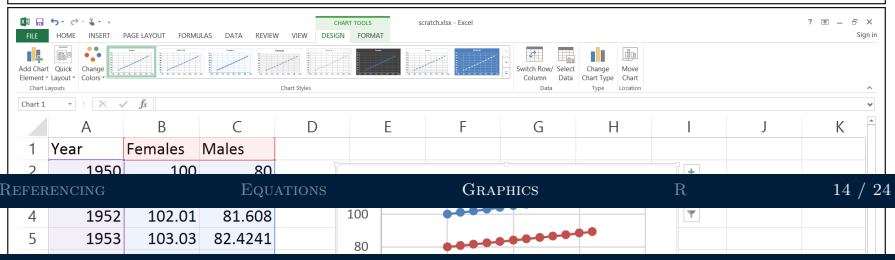


Graphics

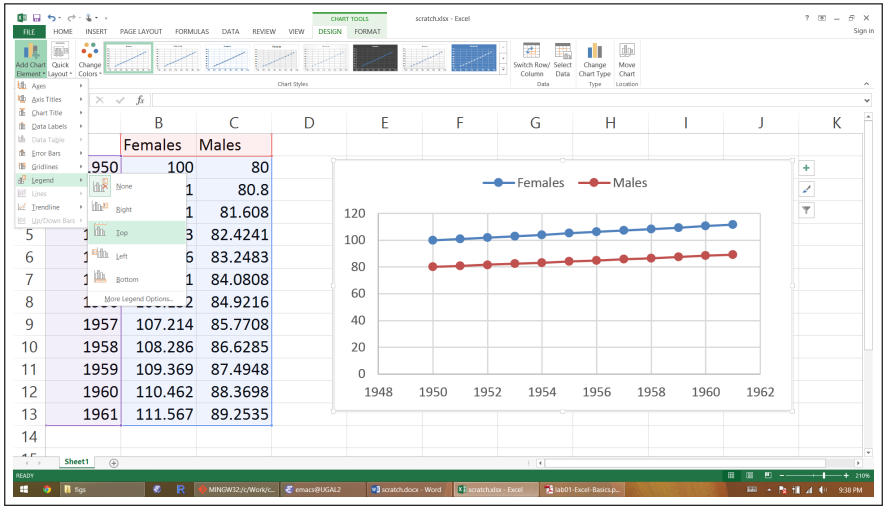


Graphics



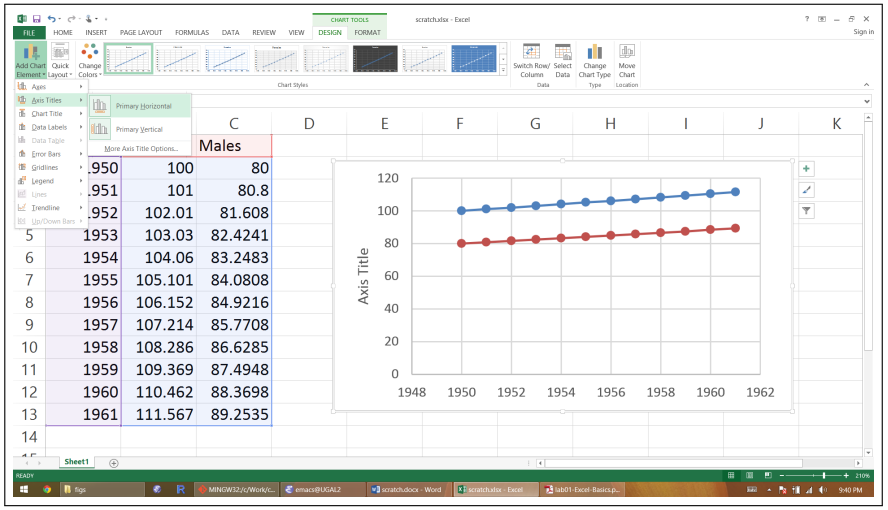


Customize



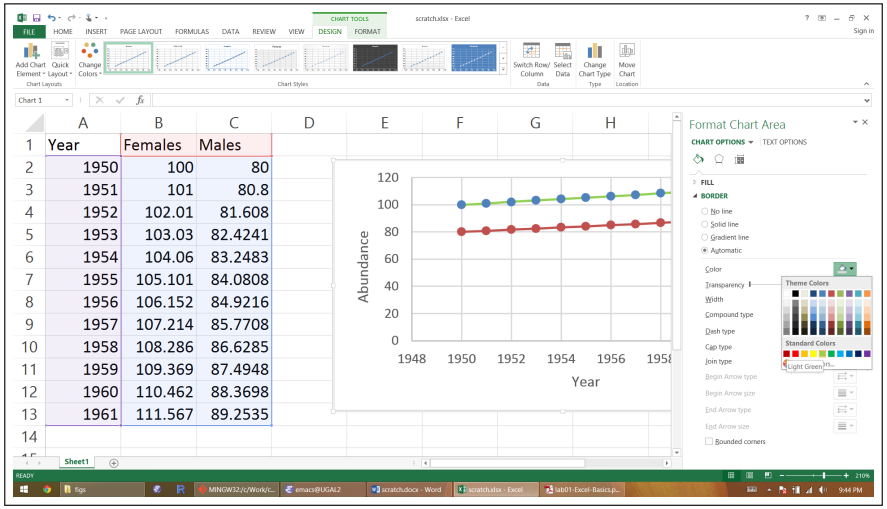
Add legend

Customize



Add axis labels

Customize



Change line color

R – Software for statistical computing

R can be downloaded here: `https://www.r-project.org/`

You can use the graphical user interface that comes with **R**, or you can run **R** through a system like **ESS+emacs** (`https://vgoulet.act.ulaval.ca/en/home/`) or **R Studio** (`https://www.rstudio.com/`).

Most people use **R Studio** these days.

Reproducing the Excel exercise

Create an object called `year` to hold the sequence of years.

```
year <- 1950:1961 # A vector of integers
year              # Type the name of an object to see its values

##  [1] 1950 1951 1952 1953 1954 1955 1956 1957 1958 1959 1960 1961
```

Use the `length` function to determine the number of values in a vector.

```
nYears <- length(year)
nYears

## [1] 12
```


A simple population model

Create an empty vector to store the data on females. Set female abundance to 100 in the first year.

```
females <- rep(NA, nYears)
females[1] <- 100
```

Use a "for loop" to compute female abundance in subsequent years.

```
for(t in 2:nYears) {
    females[t] <- females[t-1] + females[t-1]*0.01
}
```

We will use "for loops" for almost every population model that we implement in R

A simple population model

Generate the data on males using a single line of code.

```
males <- females*0.8
```

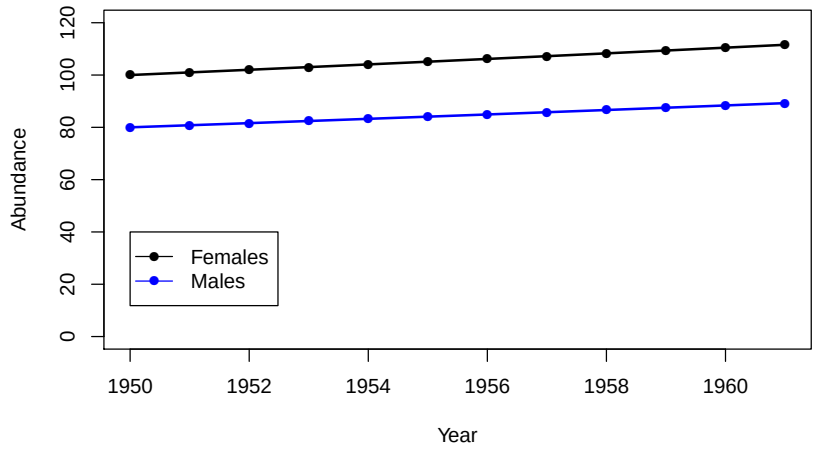
Put the objects in a `data.frame`

```
model1 <- data.frame(year, females, males)
model1

##    year  females    males
## 1  1950 100.0000 80.00000
## 2  1951 101.0000 80.80000
## 3  1952 102.0100 81.60800
## 4  1953 103.0301 82.42408
## 5  1954 104.0604 83.24832
## 6  1955 105.1010 84.08080
## 7  1956 106.1520 84.92161
## 8  1957 107.2135 85.77083
## 9  1958 108.2857 86.62854
## 10 1959 109.3685 87.49482
## 11 1960 110.4622 88.36977
## 12 1961 111.5668 89.25347
```


Graphics

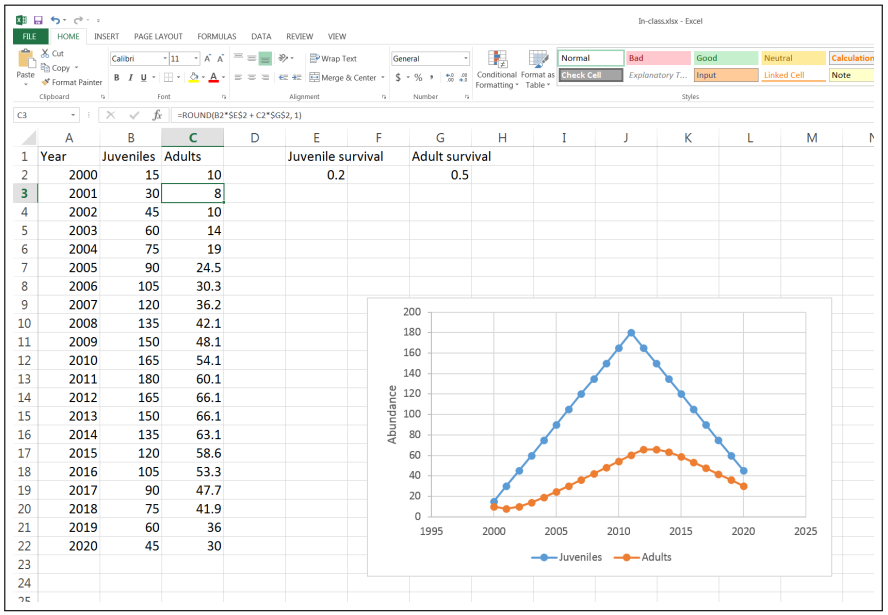
```
plot(females ~ year, data=model1, type="o", xlab="Year", ylab="Abundance",
     lwd=2, pch=16, ylim=c(0, 120))
lines(males ~ year, data=model1, type="o", col="blue", lwd=2, pch=16)
legend(x=1950, y=40, legend=c("Females", "Males"), col=c("black", "blue"), lty=1, pch=16)
```



Assignment

1. Create an Excel file and name it "Yourlastname_Yourfirstname".
2. Create the sheet shown on the next page using the techniques covered in this lab.
   - Use auto-fill to create the first two columns.
   - For the "Adults" column, use the equation shown for cells C3 through C22. Note: For cell C2, you can directly enter the value "10".
3. Copy "Sheet1" to a new sheet and change the color and thickness of the lines. You can pick any colors and thicknesses you want.
4. Grad students only: Do steps 1-3 using Excel, and also replicate the process using a "for loop" in a self-contained **R** script.
5. Upload the Excel workbook (with both sheets) to ELC. Grad students: upload the R script too.

Assignment



Year	Juveniles	Adults
2000	15	10
2001	30	8
2002	45	10
2003	60	14
2004	75	19
2005	90	24.5
2006	105	30.3
2007	120	36.2
2008	135	42.1
2009	150	48.1
2010	165	54.1
2011	180	60.1
2012	165	66.1
2013	150	66.1
2014	135	63.1
2015	120	58.6
2016	105	53.3
2017	90	47.7
2018	75	41.9
2019	60	36
2020	45	30