

R Terminology

- R: the main program
- RStudio: a companion program for R, makes R easier to use and has additional features
- packages: collection of functions that can be shared/downloaded
 - these are developed by users around the world!
 - they make tasks easier
- scripts: file with commands for R
 - written in the scripts window in Rstudio
 - can be saved and shared with others

R Terminology

- objects: anything stored or “remembered” by R
 - objects have names
 - example: lists, datasets, variables, a number
 - objects can be used in commands/functions
 - your objects will be displayed in the environment window of RStudio
- functions: code operation/series of rules to apply to an object or number that will return an answer
 - R already knows some functions
 - we can create our own functions

Getting Help in R

- help pages: *lm* function
 - What are the function inputs called in R terminology?
 - What are the function outputs called in R terminology?
 - What else does the help file tell you about *lm*?

Getting Help in R

- help pages: *lm* function
 - Copy the first 8 lines from the example in the *lm* help file (starting with “## Annette Dobson”)
 - Type these commands:
 - `lm.D9`
 - `summary(lm.D9)`
 - `attributes(lm.D9)`
 - What is being returned?
 - What is `lm.D9`?

Plots in R

- Flu data are plotted with points and lines
 - we specified type “b” for “both”
 - Use the help file and create a line plot and point plot for the case data

Random Numbers

- R can generate random numbers for us
- We use random numbers from different distributions in mathematical models (and for other purposes)
 - normal, lognormal, binomial, Poisson, etc.

Random Numbers

- Generate 100 random numbers from a normal distribution and plot a histogram

SIR Model

- We will use R to solve these equations
- We can enter our own values for some of the parameters

$$\frac{dS(t)}{dt} = -\beta S(t)I(t)$$

$$\frac{dI(t)}{dt} = \beta S(t)I(t) - \gamma I(t)$$

$$\frac{dR(t)}{dt} = \gamma I(t)$$

SIR Model

- We will use R to solve these equations
- We can enter our own values for some of the parameters
- Which parameters will we know?

$$\frac{dS(t)}{dt} = -\beta S(t)I(t)$$

$$\frac{dI(t)}{dt} = \beta S(t)I(t) - \gamma I(t)$$

$$\frac{dR(t)}{dt} = \gamma I(t)$$

SIR Model

- Phase portrait
 - also called phase diagram
 - compares two parts of the model system to one another, showing their evolution over time

SIR Model Practice

- What happens if you change the values of beta and gamma?
Explore a range of values for each and plot the results (time series and phase space)

SIR Model Practice

- What happens if we change the initial conditions? What if some people are already immune at the start of the epidemic?