

1. Download R from the Comprehensive R Archive Network and install it on your computer. Use the `help` function to learn about the commands `plot`, `seq`, `par`, `lines`, `legend`, `rnorm`, `hist`, `paste`, `image`, `heatmap`, and `boxplot`. Why did we choose this list of functions for you to learn about?
2. Plot  $\sin(x)$  on the interval  $0 \leq x \leq 3\pi$ . Label the axes with something meaningful.
3. Plot both  $\sin(x)$  and  $\cos(x)$  for  $0 \leq x \leq 3\pi$  on the same axes. Use colors or line styles to distinguish the two curves. Include a figure legend that explains how to tell which curve is which.
4. Generate a random normal vector containing 1000 elements.
  - (a) Plot the data.
  - (b) Plot the data after first sorting it in increasing order.
  - (c) Plot a histogram of the data.
  - (d) Plot a histogram of the data with 70 bars.
5. Generate two random normal vectors  $x$  and  $y$ , each containing 100 elements.
  - (a) Compute the correlation coefficient between  $x$  and  $y$ .
  - (b) Plot  $y$  as a function of  $x$ , and add the correlation coefficient to the plot (as a legend, a label, or a text string).
  - (c) Perform a  $t$ -test comparing  $x$  and  $y$ . What are the  $t$ -statistic and the  $p$ -value?
  - (d) Let  $z = y + 1$ . Repeat parts (a) and (c) using  $z$  instead of  $y$ .
  - (e) Let  $z = y + k$  for a constant  $k$  of your choice. Repeat parts (a) and (c) using  $z$  instead of  $y$ . How large should you choose  $k$  to ensure that the  $p$ -value is smaller than 0.05?
  - (f) Repeat part (e) when  $x$  and  $y$  contain only 25 elements.
6. Generate a random normal matrix with 100 rows and 50 columns.
  - (a) Draw an image of the matrix. Change the axes so they indicate the correct row and column numbers.
  - (b) Experiment with the color options and redraw the image using a non-default color map.
  - (c) Draw a heatmap of the matrix.
  - (d) Convert the matrix into a `data.frame`, and draw a boxplot of the `data.frame`.
7. Read the R help documentation on `library`, which explains how to use the extra tools available in R libraries. Load the `lattice` package and work through the examples in the help page for `wireframe` and `cloud`.