Lab #3 Activities

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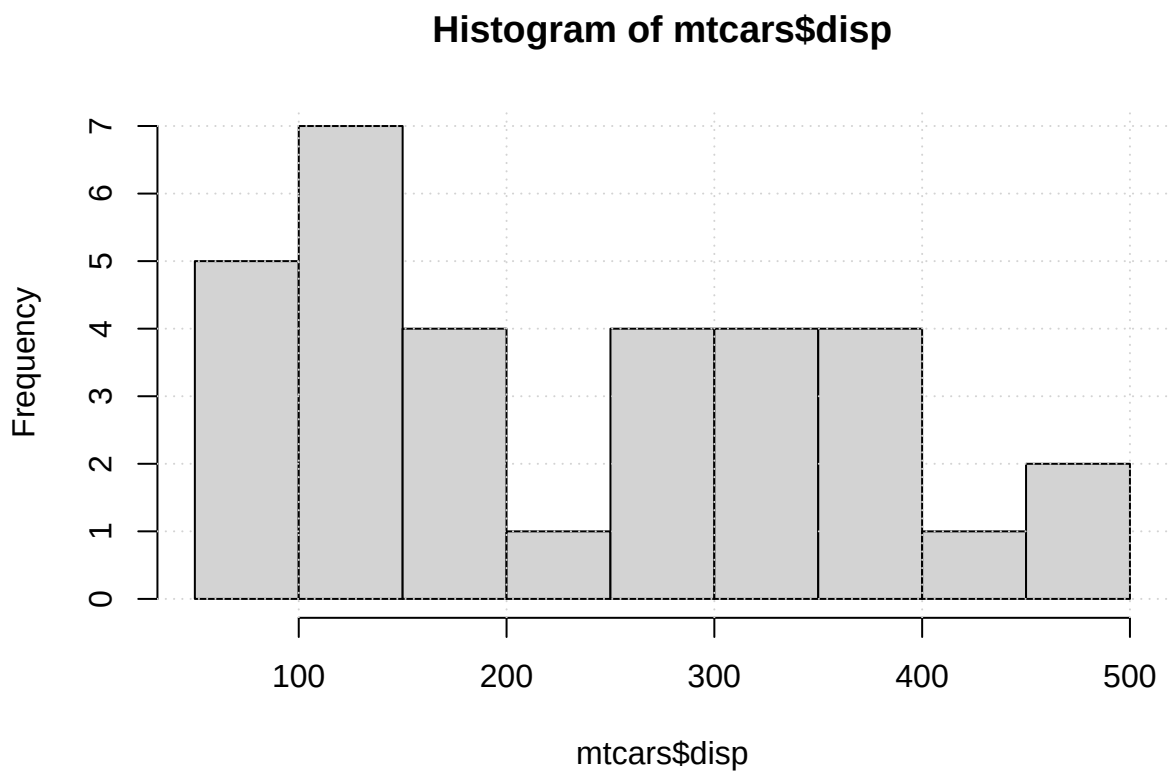
A reminder that the R code we have covered in class is available on the lecture section UM Learn page, under **Content** > **Course Material**.

Knit this file to pdf to see the questions in a more readable format.

Question 1:

The histogram below shows that there are 7 cars in the `mtcars` dataset with an engine displacement higher than 350 (the 350-400 bar excludes 350).

```
hist(mtcars$disp)
grid()
```



Print the `mtcars` data frame subsetted, showing only these 7 cars in increasing order of engine displacement.

```
cars = mtcars[mtcars$disp > 350,]
orderedCars = cars[order(cars$disp), ]
```

```
print(orderedCars)
```

```
##                      mpg cyl disp  hp drat    wt  qsec vs am gear carb
## Ford Pantera L      15.8   8  351 264 4.22 3.170 14.50  0  1    5    4
## Hornet Sportabout   18.7   8  360 175 3.15 3.440 17.02  0  0    3    2
## Duster 360          14.3   8  360 245 3.21 3.570 15.84  0  0    3    4
## Pontiac Firebird    19.2   8  400 175 3.08 3.845 17.05  0  0    3    2
## Chrysler Imperial   14.7   8  440 230 3.23 5.345 17.42  0  0    3    4
## Lincoln Continental 10.4   8  460 215 3.00 5.424 17.82  0  0    3    4
## Cadillac Fleetwood  10.4   8  472 205 2.93 5.250 17.98  0  0    3    4
```

Question 2:

The following is a complicated-looking expression involving natural logs and exponentials:

$$e^{\ln(4^2)} + \ln(e^{3\ln(4)}) - \frac{e^{\ln(4^3)}}{4}$$

(In this expression, ln(4^2), 3 ln(4), and ln(4^3) are in the exponents.)

However, if we know our properties of logarithms and exponentials, we can show that the expression simplifies to `3*ln(4)`, which is approximately 4.16. Suppose you do not know the properties of logarithms and exponentials, so you code the complicated-looking expression and see what it equals. Write the R code for the complicated expression so that when you knit to pdf, you see that it simplifies to approximately 4.16.

```
solution = exp(log( 4 ^ 2)) + log(exp(3 * log(4))) - (exp(log(4 ^ 3)) / 4)
print(solution)
```

```
## [1] 4.158883
```

Question 3:

The volume of a hollow cylinder, as shown at the link provided in Crowdmark, is $V = \pi(R^2 - r^2)h$, where R is the outer radius, r is the inner radius, and h is the height. Of course, this is because we first find the volume of the whole cylinder ($V = \pi R^2 h$) and then remove the volume of the hollow part ($V = \pi r^2 h$).

Write an R function that calculates the volume of a cylinder. We will call this function twice, once with the larger radius and once with the smaller radius, to find the volume of a hollow cylinder. Your function should have two inputs: the radius of the cylinder and the height. The R code for the number π is simply **pi**:

```
calcVol = function (height, radius) {
  volume = pi * (radius ^ 2) * height
  return (volume)
}
```

Once your function is written, use it to calculate the volume of a hollow cylinder (in cubic centimetres) with a height of 16 cm, an inner radius of 3 cm and an outer radius of 6 cm.

```
calcCylinder = calcVol(16, 6) - calcVol(16, 3)
print(calcCylinder)
```

```
## [1] 1357.168
```