

Exercise 1 - How Deep is the Ocean? September 17, 2018.

EPIB607 - Inferential Statistics^a

^aFall 2018, McGill University

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This in-class exercise will introduce you to sampling distributions for means and proportions.

Sampling distribution | Means | Proportions | Standard error | Standard deviation | Parameter | Statistic

1. What percentage of the world's surface is covered by water?

The data provided by the [Scripps Institution of Oceanography](#) can provide an answer, but some work is required on your part. James Hanley (JH) has randomly sampled $n = 5$ and $n = 20$ latitudes and longitudes for every student in the class. This document contains unique latitudes and longitudes for

```
[1] "Bhatnagar, Sahir"
```

and was sent in an email (using the [gmailr](#) package) as a pdf attachment to the following address:

```
[1] "sahir.bhatnagar@mcgill.ca"
```

A sample of 5.

```
Latitude.n.5 <- c(8.042,45.329,37.743,-12.237,21.552)
```

```
Longitude.n.5 <- c(35.241,125.735,-134.383,-23.623,-5.339)
```

A sample of 20.

```
Latitude.n.20 <- c(40.428,59.851,-38.35,-8.862,-26.312,-49.721,-4.02,44.028,-36.308,22.071,  
44.765,-18.818,37.185,41.768,-5.255,14.199,61.165,10.874,-27.083,15.792)
```

```
Longitude.n.20 <- c(57.814,40.026,131.012,-145.304,-130.685,48.011,59.257,111.303,41.137,-61.05,  
159.666,-110.195,-87.961,-118.8,99.592,-102.281,159.827,-166.667,-2.171,-6.664)
```

1.1. Determine the proportion of water from the sample of 5.

1. Using the sample of 5, manually enter the latitudes and longitudes in [Google maps](#) and record if you land on water or land. Figure 1 shows how to enter them.



Fig. 1. Latitude and longitude in Google maps. Latitudes range from (-90,90) and longitudes range from (-180, 180). Latitude is entered first followed by longitude and separated by a comma.

2. In R, store your results in a binary vector of length 5. For example, if your sample landed on water 3 times out of 5, then you would enter the following in R (1 for water and 0 for land):

```
landed_in_water <- c(1,1,1,0,0)
```

3. Using R, estimate the percentage of the world's surface covered by water from your sample of 5. This can be done by simply taking the mean of the binary vector created in Step 2: `mean(landed_in_water)`.
4. Enter your estimate in this [Google sheet](#) next to your name and in the column titled `PropnW.5.locations`.

1.2. Determine the proportion of water from the sample of 20.

1. Repeat the above steps for the sample of 20. **Before you do**, take a moment to think about how tedious a process it can be to manually enter 20 latitudes and longitudes into Google maps. JH and SB hope you can appreciate the parallels between this toy exercise and that of collecting data for your research projects, i.e., it becomes increasingly difficult to collect more and more samples.

Now that you appreciate the amount of work it takes to estimate the proportion of water from 20 samples, JH and SB think it is sufficient for you to use some automatic procedures to complete this task, which are further described in step 2.

2. Create an R script and copy paste the following index vector into it:

```
index.n.20 <- c(2131,2132,2133,2134,2135,2136,2137,2138,2139,2140,  
2141,2142,2143,2144,2145,2146,2147,2148,2149,2150)
```