

ESM 262: Computing Assignment 5

Taylor Cook and Kelsey Warren

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Design a function - you can pick any subject and you can even make up the equations as long as they conceptually make sense

- Make sure it has at least 2 inputs and 1 parameter (ideally more) and at least 2 outputs
- Code your function in R, save as a R file in subdirectory called R
- Make sure you include documentation (both at the top as we've shown in past examples, and inline)
- Include some error checking

```
#' To estimate the oil spill area (km^2) and thickness of oil spill spread (mm) after an oil spill in t  
#'  
#' @param volume the volume of oil that leaked in the spill (m^3)  
#' @param wtemp the water temperature of the ocean (degrees C)  
#' @param windspeed the wind speed (m/s)  
#' @param viscosity the oil viscosity factor  
#' @param ratecoeff the spread rate coefficient  
#'  
#'  
#' @return list with the following items  
#' \describe{  
#' \item{area}{Area of oil spill spread (km^2)}  
#' \item{thickness}{Thickness of the oil spill spread (mm)}  
#' }  
#'  
#'  
#' @examples  
#' oil(volume, wtemp, windspeed, viscosity=0.0001, ratecoeff=0.16)  
#' @references  
#' https://link.springer.com/chapter/10.1007/978-1-4684-9019-0\_5  
  
oil = function(volume, wtemp, windspeed, viscosity, ratecoeff) {  
  
  # error checking  
  # check volume  
  volume = ifelse( (volume<0), return("Caution: oil volume cannot be negative"), volume)  
  
  # check wtemp
```

```

wtemp = ifelse( (wtemp<0), return("Caution: ocean temperature is below freezing"), wtemp)

# check windspeed
windspeed = ifelse( (windspeed<0), return("Caution: windspeed cannot be negative"), windspeed)

# check viscosity
viscosity = ifelse( (viscosity<0), return("Caution: viscosity cannot be negative"), viscosity)

# check ratecoeff
ratecoeff = ifelse( (ratecoeff<0), return("Caution: ratecoeff cannot be negative"), ratecoeff)

# make some adjustments to oil spread based on ocean temperature and wind speed
# ocean temperature adjustment
wtemp_adj = 1 + (wtemp-15) * 0.01 # warmer water increases spread rate. for every 1C above 15C, spread
# windspeed adjustment
windspeed_adj = 1 + (windspeed * 0.05) # faster wind speed increases spread. each 1m/s increase in wind

# calculate oil spill area (km^2) using Fay's Model for Spill Area
area = ratecoeff * (volume^(2/3)) * wtemp_adj * windspeed_adj

# calculate oil spread thickness (mm)
thickness = (volume / (area * 1e6)) * 10^3 # multiply area*10^6 for km^2 --> m^2; multiply thickness (m)

# output from function
return(list(area_km2=round(area,3), thickness_mm=round(thickness,3)))
}

```

In an Quatro file, generate some data for 2 of the function inputs

- use a **for** loop to run the function for the data
- repeat the "looping" using something from the "purrr" package
- Graph results (you can decide what the most interesting way to graph - you just need to make one graph)

```

#Generate data for 2 of the function inputs
volume = c(100000, 200000, 300000, 400000, 500000)
wtemp = c(10, 15, 20, 25, 30)
windspeed <- rep(15, length(volume))

# run the function for the data using a for loop
results = list()
for (i in 1:length(volume)) {
  results[[i]] = oil(volume[i], wtemp[i], windspeed=15, viscosity=0.0001, ratecoeff=0.16)
}

print(results)

```

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

```
## [[1]]$area_km2
## [1] 573.08
##
## [[1]]$thickness_mm
## [1] 0.174
##
##
## [[2]]
## [[2]]$area_km2
## [1] 957.587
##
## [[2]]$thickness_mm
## [1] 0.209
##
##
## [[3]]
## [[3]]$area_km2
## [1] 1317.533
##
## [[3]]$thickness_mm
## [1] 0.228
##
##
## [[4]]
## [[4]]$area_km2
## [1] 1672.081
##
## [[4]]$thickness_mm
## [1] 0.239
##
##
## [[5]]
## [[5]]$area_km2
## [1] 2028.473
##
## [[5]]$thickness_mm
## [1] 0.246
```

```
# repeat the "looping" using something from the "purrr" package
results_purrr = purrr::pmap(list(volume, wtemp, windspeed=15), ~oil(.x, .y, 15, viscosity=0.0001, rateco
print(results_purrr)
```

```
## [[1]]
## [[1]]$area_km2
## [1] 573.08
##
## [[1]]$thickness_mm
## [1] 0.174
##
##
## [[2]]
## [[2]]$area_km2
## [1] 957.587
```

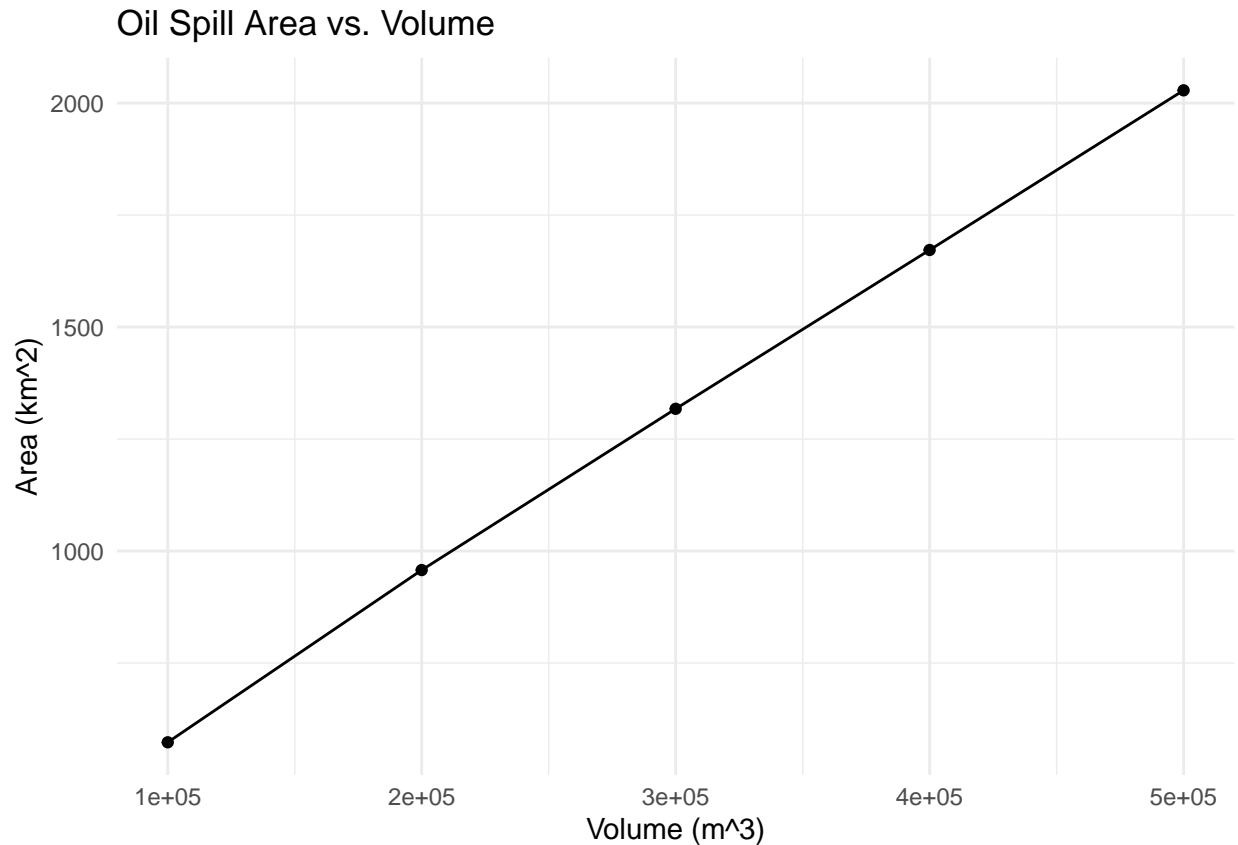
```
##
## [[2]]$thickness_mm
## [1] 0.209
##
##
## [[3]]
## [[3]]$area_km2
## [1] 1317.533
##
## [[3]]$thickness_mm
## [1] 0.228
##
##
## [[4]]
## [[4]]$area_km2
## [1] 1672.081
##
## [[4]]$thickness_mm
## [1] 0.239
##
##
## [[5]]
## [[5]]$area_km2
## [1] 2028.473
##
## [[5]]$thickness_mm
## [1] 0.246
```

```
# Graph results of both methods
```

```
results_df = bind_rows(results) %>%
  mutate(volume = volume, wtemp = wtemp, windspeed = windspeed)

results_purrr_df = bind_rows(results_purrr) %>%
  mutate(volume = volume, wtemp = wtemp, windspeed = windspeed)

results_df %>%
  ggplot(aes(x = volume, y = area_km2)) +
  geom_point() +
  geom_line() +
  labs(title = "Oil Spill Area vs. Volume", x = "Volume (m^3)", y = "Area (km^2)") +
  theme_minimal()
```



Write at least 2 tests for your function; store in a separate test file

Put this in a git repo that includes an R subdirectory, a tests subdirectory and your Quatro file and submit the link on Canvas (you can put all of this in a new git repo or a subdirectory of an existing git repo)