Homework 9

Mitchelle Mojekwu

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#Task 1 Write code in R that uses Newton-Raphson to find the square root of a number c, i.e., use the function $f(x) = x^2 - c$. With $c = 650$ and a starting point of $x_1 = 10$, how many steps does it take (i.e. what is the value of t) for the error in the approximation to first become less than 0.001?

```
x_t <- 10 #starting point
x_tt <- 100000 #this is x_t+1
t <- 0 #tracks iterations

while(abs(x_tt - x_t) >= 0.001){ #iterate until |x_t+1 - x_t| is less thann 0.001
  if (t>0){
    x_t <- x_tt
  }
  fx <- x_t ^ 2 - 650 #scalar function
  d_fx <- 2*x_t
  x_tt <- x_t -(fx/d_fx) #x_t+1 = x_t - [f(x_t)/f'(x_t)]
  t <- t+1
}
t
```

```
## [1] 5
```

```
x_t
```

```
## [1] 25.49519
```

```
x_tt
```

```
## [1] 25.4951
```

As seen above, it takes 5 steps for the error in the approximation to first become less than 0.001. i.e. $t = 5$.

#Task 2

Perform logistic regression to study the probability of failure as a function of temperature.

```
#glimpse(alr4::Challeng)
oring <- alr4::Challeng

#fail: # of o-rings that have failed (failure is when 1 or 2 o-rings fail)
#temp: air temperature at launch (degrees F)

#add factor column where 0=no fail o-rings failed, 1= >0 o-rings failed
oring$fail_fact <-ifelse(oring$fail >0,1,0)
glimpse(oring)
```

```
## Rows: 23
## Columns: 8
```

```
## $ temp      <int> 66, 70, 69, 68, 67, 72, 73, 70, 57, 63, 70, 78, 67, 53, 67, ~
## $ pres      <int> 50, 50, 50, 50, 50, 50, 50, 100, 100, 200, 200, 200, 200, 20~
## $ fail      <int> 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 2, 0, 0, 0, 0, 0, 0, ~
## $ n         <int> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, ~
## $ erosion   <int> 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 3, 0, 0, 0, 0, 0, 0, ~
## $ blowby    <int> 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 2, 0, 0, 0, 0, 0, 0, ~
## $ damage    <int> 0, 4, 0, 0, 0, 0, 0, 0, 4, 2, 4, 0, 0, 11, 0, 0, 0, 0, 0, 0,~
## $ fail_fact <dbl> 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, ~
```

```
#Logistic Regression
oring_model <- glm(fail_fact==1 ~ temp, data = oring, family = "binomial")

tidy(oring_model) %>%
  kable(digits = 3)
```

term	estimate	std.error	statistic	p.value
(Intercept)	15.043	7.379	2.039	0.041
temp	-0.232	0.108	-2.145	0.032