

## 1 Arithmetic

1.  $1/3 + 1/4$   
 $> (1/3) + (1/4)$   
 $[1] 0.5833333$
2.  $2^{10} + 1$   
 $> (2^{10}) + 1$   
 $[1] 1025$
3.  $1127 \ln(1 + f / 700)$  (the conversion from Hz to mel) where  $f = 440$   
 $> f <- 440$   
 $> 1127 * (\log(1 + (f / 700)))$   
 $[1] 549.6415$
4.  $(-b + (\sqrt{b^2 - 4ac})) / 2a$  (one solution for a quadratic equation) where  $a = 2$ ,  $b = 4$ , and  $c = -4$   
 $> a <- 2$   
 $> b <- 4$   
 $> c <- -4$   
 $> (-b + (\sqrt{(b^2) - (4 * a * c)})) / (2 * a)$   
 $[1] 0.7320508$

## 2 Categorical Data

1. **How many times did employees at the three department stores use  $r$  in the word “fourth” in the emphatic condition?**  
 $> nyc <- \text{read.csv}(\text{"NYC.csv"}, \text{header} = \text{TRUE})$   
 $> \text{table}(nyc\$word == \text{"fourth"} \ \& \ nyc\$r == 1 \ \& \ nyc\$emphasis == \text{"emphatic"})$   
 There are 35 instances where employees from the three department stores use  $r$  in the word “fourth” in the emphatic condition.
2. **What percentage of the time did employees at S. Klein’s use  $r$  in the word “floor”?**  
 $> \text{klinez} <- \text{subset}(nyc, nyc\$store == \text{"Klein's"})$   
 $> \text{prop.table}(\text{table}(\text{klinez}\$r == 1 \ \& \ \text{nd}\$word == \text{"floor"}))$   
 $> \text{prop.table}(\text{table}(nyc\$store == \text{"Klein's"} \ \& \ nyc\$r == 1 \ \& \ nyc\$word == \text{"floor"}))$   
 The employees at S. Klein’s used  $r$  in the word “floor” 5.555556% of the time. Compared to overall instances, employees at S. Klein’s used  $r$  in the word “floor” 1.646091% of the time.

## 3 Ratio Data

1. **Sample quartiles for VOT (NB: the 2nd quartile, AKA the 50% percentile, is the median)**  
 $> \text{votfile} <- \text{read.table}(\text{file} = \text{"VOT.tsv"}, \text{sep} = \text{"\t"}, \text{header} = \text{TRUE})$   
 $> \text{summary}(\text{votfile}\$vot)$   
 For VOT, the 1<sup>st</sup> quartile is -17.98, the 2<sup>nd</sup> quartile/median is 13.82, and the 3<sup>rd</sup> quartile is 27.36.
2. **The mean of Spanish speakers’ VOTs**  
 $> \text{votspan} = \text{votfile}[\text{votfile}\$language == \text{"spanish"},]$   
 $> \text{summary}(\text{votspan}\$vot)$   
 The mean value of Spanish speakers’ VOT is -24.31.
3. **The (sample) standard deviation of English speakers’ VOTs**  
 $> \text{voteng} = \text{votfile}[\text{votfile}\$language == \text{"english"},]$   
 $> \text{sd}(\text{voteng}\$vot)$   
 $[1] 19.86479$   
 The standard deviation of English speakers’ VOTs is 19.86479.