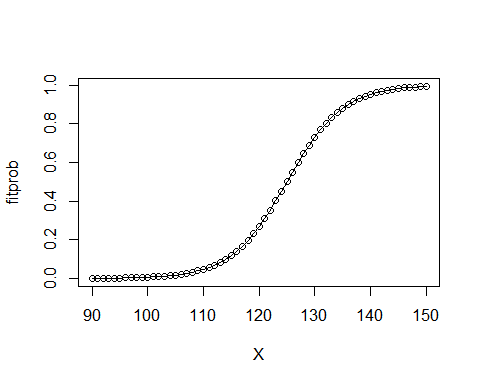
### Math 317 - Chapter 14 Homework 1

### Ahmad M. Osman

1. Plot the logistic mean function, , when and .

# Insert your R code here. Use the X values provided.  
X = seq (90, 150)  
fitprob = exp (-25 + 0.2\*X) / (1 + exp (-25 + 0.2\*X))  
plot (X, fitprob)  
lines (X, fitprob)



2. What is the predicted probability for X=115?

# Insert your R code here  
Xj = 115  
exp (-25 + 0.2\*Xj) / (1 + exp (-25 + 0.2\*Xj))

## [1] 0.1192029

The predicted probability when X = 115 is 0.1192.

3. For what value of X is the mean response equal to 0.5? (Solve for X algebraically, then calculate in R)

# Insert your R code here  
X\_5 = (log (0.5/(1-0.5)) + 25)/0.2  
X\_5

## [1] 125

When the mean response equal to 0.5, the value of X is 125.

3. Find the odds when , when , and the odds ratio for X=131 vs. X=130. Verify that this odds ratio is equal to .

# Insert your R code here  
Xk = c(130, 131)  
fitprob2 = exp (-25 + 0.2\*Xk) / (1 + exp (-25 + 0.2\*Xk))  
odds2 = fitprob2 / (1 - fitprob2)  
odds2

## [1] 2.718282 3.320117

odds.ratio = odds2[2] / odds2[1]  
odds.ratio

## [1] 1.221403

exp(0.2)

## [1] 1.221403

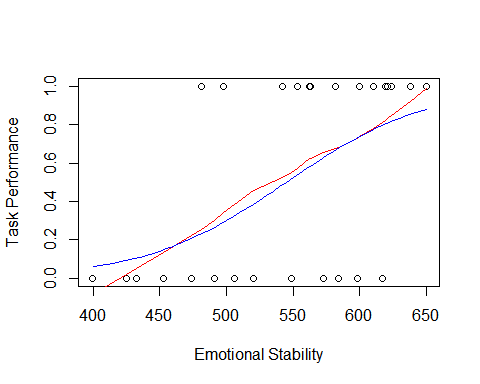
When X = 130 and X = 131, the odds are 2.718 and 3.320 respectively. The odds ratio is 1.221. As we can see above calculation, the odds ratio is equal to exp(B1) which is 1.221

A psychologist conducted a study to examine the nature of the relation, if any, between an employee's emotional stability (X) and the employee's ability to perform in a task group (YJ. Emotional stability was measured by a written test for which the higher the score, the greater is the emotional stability. Ability to perform in a task group (Y = 1 if able, Y = 0 if unable) was evaluated by the supervisor.

taskperf = c(0, 0, 0, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 1)  
emostab = c(474, 432, 453, 481, 619, 584, 399, 582, 638, 624, 542, 650, 553, 425, 563, 549, 498, 520, 610, 598, 491, 617, 621, 573, 562, 506, 600)  
plot (emostab, taskperf, xlab="Emotional Stability", ylab="Task Performance")  
lines (lowess (taskperf ~ emostab), col='red')  
logistic.fit = glm (taskperf ~ emostab, family=binomial)  
summary (logistic.fit)

##   
## Call:  
## glm(formula = taskperf ~ emostab, family = binomial)  
##   
## Deviance Residuals:   
## Min 1Q Median 3Q Max   
## -1.7845 -0.8350 0.5065 0.8371 1.7145   
##   
## Coefficients:  
## Estimate Std. Error z value Pr(>|z|)   
## (Intercept) -10.308925 4.376997 -2.355 0.0185 \*  
## emostab 0.018920 0.007877 2.402 0.0163 \*  
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1  
##   
## (Dispersion parameter for binomial family taken to be 1)  
##   
## Null deviance: 37.393 on 26 degrees of freedom  
## Residual deviance: 29.242 on 25 degrees of freedom  
## AIC: 33.242  
##   
## Number of Fisher Scoring iterations: 4

emostab.seq = seq(400, 650, by=5)  
X <- cbind(1, emostab.seq)  
betahat = coefficients(logistic.fit)  
Xb <- X %\*% betahat  
prob <- exp(Xb)/(1+exp(Xb))  
  
lines(emostab.seq, prob, col='blue')



Obtain and interpret that number.

exp(0.018920)

## [1] 1.0191

The number obtained from is the odds ratio which is equal to 1.019. This odds ratio can be interpreted as following: the odds of the estimated employee's ability to perform in a task group increases by 1.9 percent for each additional unit increase in employee's emotional stability.