MATH 523: EXAMPLE - BINOMIAL DATA, CODE AND RESULTS

```
1  library(faraway)
2  data(orings)
3
4  plot(damage/6 ~ temp, orings, xlim=c(20,85), ylim = c(0,1),
5       xlab="Temperature", ylab="Prob of damage",pch=19)
6
7  lmod <- lm(damage/6 ~ temp, orings)
8  abline(lmod)
9
10 logitmod <- glm(cbind(damage,6-damage) ~ temp, family=binomial, orings)
11 plot(damage/6 ~ temp, orings, xlim=c(20,85), ylim = c(0,1),
12      xlab="Temperature", ylab="Prob of damage",pch=19)
13
14 x <- seq(20,85,1)
15 lines(x,ilogit(coef(logitmod)[1]+coef(logitmod)[2]*x))
16 probitmod <- glm(cbind(damage,6-damage) ~ temp, family=binomial(link=probit), orings)
17 lines(x,pnorm(coef(probitmod)[1]+coef(probitmod)[2]*x),lty=2)
18 abline(lmod,lty=3)
19 legend(20,0.4,c("Logit","Probit","Linear"),lty=c(1:3))
20
21 summary(lmod)
22 summary(logitmod)
23 summary(probitmod)
24
25 ilogit(coef(logitmod)[1]+coef(logitmod)[2]*31)
```

Results for the linear model:

```
> summary(lmod)
Call:
lm(formula = damage/6 ~ temp, data = orings)

Residuals:
     Min       1Q   Median       3Q      Max
-0.13786 -0.10345 -0.02369  0.06601  0.48345

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  1.21429    0.29993   4.049 0.000578 ***
temp        -0.01631    0.00429  -3.801 0.001043 **
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

Residual standard error: 0.142 on 21 degrees of freedom
Multiple R-squared: 0.4076,     Adjusted R-squared: 0.3794
F-statistic: 14.45 on 1 and 21 DF,  p-value: 0.001043
```

Results for the logistic GLM:

```
> summary(logitmod)
Call:
glm(formula = cbind(damage, 6 - damage) ~ temp, family = binomial,
    data = orings)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-0.9529  -0.7345  -0.4393  -0.2079   1.9565

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) 11.66299    3.29626   3.538 0.000403 ***
temp        -0.21623    0.05318  -4.066 4.78e-05 ***
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 38.898  on 22  degrees of freedom
Residual deviance: 16.912  on 21  degrees of freedom
AIC: 33.675

Number of Fisher Scoring iterations: 6
```

Results for the probit GLM:

```
> summary(probitmod)
Call:
glm(formula = cbind(damage, 6 - damage) ~ temp, family = binomial(link = probit),
    data = orings)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.0134  -0.7761  -0.4467  -0.1581   1.9983

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept)  5.59145    1.71055   3.269  0.00108 **
temp        -0.10580    0.02656  -3.984 6.79e-05 ***
---
Signif. codes:  0  ***  0.001  **  0.01  *  0.05  .  0.1     1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 38.898  on 22  degrees of freedom
Residual deviance: 18.131  on 21  degrees of freedom
AIC: 34.893

Number of Fisher Scoring iterations: 6
```

Comparison of fit at T=31:

```
> (coef(lmod)[1]+coef(lmod)[2]*31)
(Intercept)
  0.7086905
> ilogit(coef(logitmod)[1]+coef(logitmod)[2]*31)
(Intercept)
  0.9930342
> pnorm(coef(probitmod)[1]+coef(probitmod)[2]*31)
(Intercept)
  0.9895983
```