MATH 3330 Section B Name _____
Quiz 5
December 3, 2001 St.Number _____

1. Consider a regression of Salary on a 'job factor' Experience that is coded with a range from 1 to 7.

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> summary(blf)
   RowNames      Knowledge       Experience   Communication   Gender
      95: 1      Min.:1.000      Min.:1.000      Min.:1.000   F:72
      94: 1   1st Qu.:3.000   1st Qu.:3.000   1st Qu.:3.000   M:23
      93: 1    Median:4.000    Median:4.500    Median:4.000
      92: 1      Mean:4.111      Mean:4.179      Mean:4.237
      91: 1   3rd Qu.:5.000   3rd Qu.:5.500   3rd Qu.:5.500
      90: 1      Max.:7.000      Max.:7.000      Max.:7.000
 (Other):89
      Salary          Female
   Min.:26180      Min.:0.0000
 1st Qu.:53770   1st Qu.:1.0000
  Median:63420    Median:1.0000
    Mean:62990      Mean:0.7579
 3rd Qu.:74510   3rd Qu.:1.0000
    Max.:90830      Max.:1.0000

> fit <- lm(Salary ~ Experience * Gender, blf)

> summary(fit)

Call: lm(formula = Salary ~ Experience * Gender, data = blf)
Residuals:
    Min    1Q Median   3Q   Max
 -13755 -2662  539.4 3315 16018

Coefficients:
                     Value  Std. Error     t value    Pr(>|t|)
      (Intercept)  37172.6134   4376.7545      8.4932      0.0000
       Experience   6970.4794    741.2442      9.4038      0.0000
           Gender   9690.2806   4376.7545      2.2140      0.0293
Experience:Gender  -1332.4762    741.2442     -1.7976      0.0756

Residual standard error: 5241 on 91 degrees of freedom
Multiple R-Squared: 0.8869
F-statistic: 238 on 3 and 91 degrees of freedom, the p-value is 0

Correlation of Coefficients:
                  (Intercept) Experience  Gender
       Experience -0.9826
           Gender  0.9232     -0.8726
Experience:Gender -0.8726      0.8191    -0.9826

> fit$contrasts
$Gender:
  [,1]
F   -1
M    1

> summary(fit)$cov.unscaled
                  (Intercept)  Experience     Gender Experience:Gender
      (Intercept)   0.6974846 -0.11606923  0.6438920       -0.10307634
       Experience  -0.1160692  0.02000566 -0.1030763        0.01638675
           Gender   0.6438920 -0.10307634  0.6974846       -0.11606923
Experience:Gender  -0.1030763  0.01638675 -0.1160692        0.02000566
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a) [5] Estimate the difference between the male salary line and the female salary line when Experience is at the low value of 1.
b) [5] Find the estimated standard deviation of the estimate in (a)

c) [5] Compute the F statistic (or t statistic) to test whether the two salary lines are equal when Experience is equal to 1. State the degrees of freedome for the F (or t) statistics.

2 [5] Give the definition of the hat matrix H in terms of the design matrix X and show that HH = H.