Name ______________________________________

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Mgt 264b
Regression Analysis with Applications to Marketing and Finance

Problem Set #4

This problem set is designed to reinforce the material on confidence intervals and hypothesis-testing in Chapter III as well as the material on prediction and residual diagnostics in Chapter IV.

1. Optimal Pricing and Hypothesis-Testing

One simple rule of pricing is the "inverse elasticity" rule that the optimal gross margin should be equal to the reciprocal of the absolute value of the price elasticity. For example, suppose we estimate that the price elasticity is -2 (a 1 per cent increase in price will reduce sales (in units) by 2 per cent. Then the optimal gross margin is 50 percent. GM=(p-c)/p where c is variable or marginal cost.

The `detergent` dataset is collected from a Chicago retailer. Suppose this retailer is earning a 25 per cent gross margin on 128 oz Tide. Test the hypothesis that this retailer is pricing optimally at the 90 percent confidence level (10 per cent significance level).

Hints:

i. use the inverse elasticity rule to determine what elasticity is consistent with a 25 per cent gross margin.

ii. Use the regression fitted in Chapter III (the log-log regression) to test the hypothesis that the slope coefficient on log-price is equal to the value hypothesized in (i).

2. More on Hypothesis-testing and the Mutual Fund Data

Run a regression of the Scudder Income fund (scudinc) on the value-weigthed market (valmrkt).

Test the hypothesis that the slope coefficient from this regression is the same as the slope coefficient from the regression of the Windsor fund return on the value-weighted market. Use the 5 per cent level of significance.

$$R_{S,t} = \alpha_S + \beta_S R_{V,t} + \varepsilon_{S,t}$$
$$R_{W,t} = \alpha_W + \beta_W R_{V,t} + \varepsilon_{W,t}$$

That is test the hypothesis:

$$H_0 : \beta_S - \beta_W = 0$$

Assume that the error terms from the Scudder regression are INDEPENDENT of the error terms in the Windsor regression.

Hints:

i. Use the t statistic. $t = \dfrac{b_S - b_W}{\text{std error}\left(b_S - b_W\right)}$

ii. remembr std error = estimated standard deviation!!

iii. $\text{Var}\left(b_S - b_W\right) = \text{Var}\left(b_S\right) + \text{Var}\left(b_W\right) - 2\,\text{cov}\left(b_S, b_W\right)$

iv. why is $\text{cov}\left(b_S, b_W\right) = 0$?

3. Some Regression Output Detective Work

Fill in the missing values in the output below:

```
> summary(lmfit)

Call:
lm(formula = y ~ x)

Residuals:
    Min      1Q  Median      3Q     Max 
-3.4845 -0.8365  0.1959  0.8728  2.8132 

Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept)   1.3877     0.2715   (i)    1.59e-06 ***
x             1.3677     (ii)     3.021  (iii)
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1 

Residual standard error: (iv) on 98 degrees of freedom
Multiple R-squared: (v)
F-statistic: 9.124 on 1 and 98 DF,  p-value: 0.003217
```

```
> anova(lmfit)
Analysis of Variance Table

Response: y
          Df  Sum Sq Mean Sq F value   Pr(>F)
x          1  15.081 15.0806  9.1243 0.003217 **
Residuals 98 161.974  1.6528
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
> predict(lmfit,new=data.frame(x=.5),int="pred")
       fit        lwr      upr
1 2.071488 -0.4926172      (vi)
```

for (vi), hint: prediction intervals are symmetric about the fitted value.