ECO5427
Exam 1 (Take-Home Component)

1. ECO5427 Computer Homework 4

2. a. State the "Delta Method" theorem.
   b. Use the "Generalized Slutsky" theorem to prove the "Delta Method" theorem.

Estimates of a Probit model for probability of sale

$$P(sold = 1) = \Phi(\alpha + \beta \cdot logt + \delta \cdot lap)$$

are reported in the box below.

```
Probit Model - The dependent variable is: sold
The data set is: mlsup2

Grad:     0.0000    LogL:  -182.0270    Size:   1.000

Regressor  Coefficient   Std. Error      t-stat       Prob>|t|
------------------------------------------------------------
Con          2.02499       0.70651       2.86619       0.00446
logt        -0.54474       0.09758      -5.58277       0.00000
lap          0.10222       0.14987       0.68209       0.49573

>> vc
vc =

   0.4991568  -0.0299733  -0.0804546
  -0.0299733   0.0095210  -0.0035908
  -0.0804546  -0.0035908   0.0224606
```

For parts (c) and (d) below you do not need to calculate the final estimates. Just establish the analytical relationship and plug the appropriate numbers into the resulting expressions.

c. Use the Delta method to get an estimate of $g(\theta) = (\beta - \delta)/\delta$.
d. Use the Delta method to get an estimate of $Var[g(\hat{\theta})]$.
e. Test the null hypothesis $H_0 : g(\theta) \leq 0$.

Generalized Slutsky Theorem

If Z_n is a kx1 vector such that $Z_n \xrightarrow{D} Z$, where where Z need not be normally distributed, and if X_n is a qx1 vector such that $X_n \longrightarrow c$, then $f(Z_n, X_n) \xrightarrow{D} f(Z, c)$ for any continuous function $f : \mathbb{R}^{k+q} \rightarrow \mathbb{R}^m$.