Problem 9.1

(a)

$$y=\begin{vmatrix}1\\-1\\2\\0\\4\\2\\2\\0\\2\end{vmatrix} \qquad X=\begin{vmatrix}1 & 0 & -1\\-1 & 1 & 0\\1 & 0 & 0\\0 & 1 & 1\\1 & 2 & 0\\0 & 3 & 0\\0 & 0 & 1\\1 & -1 & 1\\0 & 0 & 1\end{vmatrix}$$

(b)

(i)

$$X'=\begin{vmatrix}1 & -1 & 1 & 0 & 1 & 0 & 0 & 1 & 0\\0 & 1 & 0 & 1 & 2 & 3 & 0 & -1 & 0\\-1 & 0 & 0 & 1 & 0 & 0 & 1 & 1 & 1\end{vmatrix}$$

$$X'X=\begin{vmatrix}5 & 0 & 0\\0 & 16 & 0\\0 & 0 & 5\end{vmatrix} \qquad (X'X)^{-1}=\begin{vmatrix}0.2 & 0 & 0\\0 & 0.06 & 0\\0 & 0 & 0.2\end{vmatrix}$$

$$X'y=\begin{vmatrix}8\\13\\3\end{vmatrix}$$

(ii)

$$b=(X'X)^{-1}X''y=\begin{vmatrix}1.600\\0.813\\0.600\end{vmatrix}$$

(iii)

$$ehat=Y-Xb=\begin{vmatrix}1\\-1\\2\\0\\4\\2\\2\\0\\2\end{vmatrix}-\begin{vmatrix}1.000\\-0.788\\1.600\\1.413\\3.225\\2.438\\0.600\\1.388\\0.600\end{vmatrix}=\begin{vmatrix}0.000\\-0.213\\0.400\\-1.413\\0.775\\-0.438\\1.400\\-1.388\\1.400\end{vmatrix}$$

(iv)

sigmahatsq=ehat'ehat/(n-3)=		1.47		
(v)				
		0.29	0	0
Sigmahatsq(X'X)^-1 =		0	0.09	0
		0	0	0.29
(vi)				
Sterr(b1)=	0.54			
Sterr(b2)=	0.3			
Sterr(b3)=	0.54			
(vii)				
SST=		18		
SSR=SST-SSE=		9.16		
RSQ =SSR/SST=		0.51		
©				
Computer Results				
Coeff	0.6	0.81	1.6	
StErrors	0.54	0.3	0.54	
Rsq/Sterror	0.51	1.21	#N/A	
F/df	2.07	6	#N/A	
SSE/SSR	9.16	8.84	#N/A	
	#N/A	#N/A	#N/A	
	#N/A	#N/A	#N/A	

Prolbem 9.2

a) Y=(hamburgers) X=(Col 1, price, Advertising, Advertising^2)
b) negative, positive, negative
C)
SHAZAM OUTPUT

```
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 Hello/Bonjour/Aloha/Howdy/G Day/Kia Ora/Konnichiwa/Buenos Dias/Nee Hau/Ciao
 Welcome to SHAZAM - Version 10.0 -  JUL 2004 SYSTEM=LINUX    PAR=   781
 |_ sample 1 20
 |_ read q p a
    3 VARIABLES AND       20 OBSERVATIONS STARTING AT OBS       1

 |_ genr asq=a*a

 |_ ols q p a asq

 REQUIRED MEMORY IS PAR=       2 CURRENT PAR=     781
  OLS ESTIMATION
        20 OBSERVATIONS     DEPENDENT VARIABLE= Q
 ...NOTE..SAMPLE RANGE SET TO:      1,     20

  R-SQUARE =   0.8645     R-SQUARE ADJUSTED =   0.8391
 VARIANCE OF THE ESTIMATE-SIGMA**2 =   3880.8
 STANDARD ERROR OF THE ESTIMATE-SIGMA =   62.296
 SUM OF SQUARED ERRORS-SSE=   62093.
 MEAN OF DEPENDENT VARIABLE =   460.20
 LOG OF THE LIKELIHOOD FUNCTION = -108.785


 VARIABLE   ESTIMATED  STANDARD   T-RATIO        PARTIAL STANDARDIZED ELASTICITY
   NAME    COEFFICIENT   ERROR      16 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
 P          -127.92      24.13      -5.302     0.000-0.798    -0.4980    -1.4552
 A           162.36      65.19       2.490     0.024 0.529     1.3249     1.3431
 ASQ        -32.686      8.522      -3.836     0.001-0.692    -2.0338    -1.1378
 CONSTANT    1035.4      155.0       6.680     0.000 0.858     0.0000     2.2499
 |_ end
```

Yes, the signs are as expected.

d)
Profit = -1035.4 + 1133.32P - 127.92P^2 - 262.36a + 162.36ap +32.686a^2 -
32.686pa^2

e) Profit = -1035.4 + 1133.32P - 127.92P^2 - 262.36*2.8 + 162.36*2.8*p
+32.686*(2.8)^2 -32.686p*(2.8)^2

= -1513.75 + 1360.85P - 127.92P^2
partial Profit/Partial P = 1360.85 - 255.84P = 0
Optimal P = 1361.67/255.84 = 5.32 rubles

f) Profit = -1035.4 + 1133.32*5 - 127.32*(5)^2 -262.36a + 162.36*5*a + 32.686a^2 - 32.686*5*a^2
= 1433.2 +549.44a - 130.74a^2
partial Profit/partial a = 549.44 - 261.48a = 0
Optimal a = 549.44/261.48 = 2.1 hundred rubles

g) Profit = -1445.93 + 1360.85p - 127,92p^2
partial profit/partial p = 1360.85 - 255.84p
Optimal p = 1360.85/255.84 = 5.32 rubles
Profit = 1373.42 + 601.4a - 141.2a^2
partial profit/parital a = 601.4 - 282.4a
Optimal a = 601.4/282.4 = 2.13 hundred rubles
*The above setting should be recommended since they represent the combined price and advertising expenditure to maximize profits.

Problem 9.3

a) Coefficient of income positive and coefficient of interest rate negative.
b)
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 Welcome to SHAZAM - Version 10.0 -  JUL 2004 SYSTEM=LINUX    PAR=   781
 |_ sample 1 24
 |_ read y m i
    3 VARIABLES AND       24 OBSERVATIONS STARTING AT OBS       1


 |_ ols m y i

 REQUIRED MEMORY IS PAR=       2 CURRENT PAR=     781
  OLS ESTIMATION
        24 OBSERVATIONS     DEPENDENT VARIABLE= M
 ...NOTE..SAMPLE RANGE SET TO:      1,     24

  R-SQUARE =   0.9953     R-SQUARE ADJUSTED =   0.9949
 VARIANCE OF THE ESTIMATE-SIGMA**2 =   66.123
 STANDARD ERROR OF THE ESTIMATE-SIGMA =   8.1316
 SUM OF SQUARED ERRORS-SSE=   1388.6
 MEAN OF DEPENDENT VARIABLE =   269.71
 LOG OF THE LIKELIHOOD FUNCTION = -82.7504


 VARIABLE   ESTIMATED  STANDARD   T-RATIO        PARTIAL STANDARDIZED ELASTICITY
   NAME    COEFFICIENT   ERROR      21 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
 Y         0.13594     0.3959E-02   34.33     0.000 0.991     1.0554     0.7276
 I         -2.5771      1.189      -2.167     0.042-0.427    -0.0666    -0.0605
 CONSTANT   89.777      4.104       21.88     0.000 0.979     0.0000     0.3329
 |_ end
```

the coefficients have the expected signs. A 1 billion dollar increase in GNP will increase quantity of money demanded by 136 million dollars. A 1 percentage point increase in the interest rate will reduce money demand by 2.577 billion dollars.

c) i) yhat = 89.777 + 0.12594*(1000) - 2.5771*12 = 194.79
ii) yhat = 89.777 + 0.12594*2000 - 2.5771*6 = 346.19

d) i) Elasticity = 0.12594*(1000/194.79) = 0.7 Ineslastic
ii) elasticity = 0.12594*(2000/346.19) = 0.79 Inelastic
With a straight line function with a positive intercept and slope, the marginal stays the same put the slope of the array become less thus the elasticity increases

toward one as the slope of the array approaches that of the marginal.

e) i) Elasticity = -2.5771*(12/194.79) = -0.16 Inelastic
ii) Elasticity = -2.5771*(6/346.19) = -0.04 Inelastic
For a downward sloping linear demand function the elasticity falls as the price variable (interest rate) falls throughout its range.

f) VARIANCE-COVARIANCE MATRIX OF COEFFICIENTS

Y	0.15677E-04		
I	-0.41173E-02	1.4142	
CONSTANT	0.34274E-02	-3.0073	16.841
	Y	I	CONSTANT

Standard error for b2 = 0.3959E-02
Covariance b2 and b3 = -0.41173E-02, It implies that on average when the estimate of the coefficient of income rises the estimate of the coefficient of the interest rate falls.

g) Rsq = 0.9952. 99.52% of the variation in money holdings for this sample is explained by changes in gross national product and the interest rate.

Problem 9.4

a) SHAZAM OUTPUT

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 Welcome to SHAZAM - Version 10.0 -  JUL 2004 SYSTEM=LINUX    PAR=   781
 |_ sample 1 24
 |_ read y m i
    3 VARIABLES AND       24 OBSERVATIONS STARTING AT OBS       1

 |_ genr lnm = log(m)
 |_ genr lny = log(y)
 |_ genr lni = log(i)

 |_ ols lnm lny lni / pcov

 REQUIRED MEMORY IS PAR=       3 CURRENT PAR=     781
  OLS ESTIMATION
        24 OBSERVATIONS     DEPENDENT VARIABLE= LNM
 ...NOTE..SAMPLE RANGE SET TO:      1,     24

  R-SQUARE =   0.9977     R-SQUARE ADJUSTED =   0.9974
 VARIANCE OF THE ESTIMATE-SIGMA**2 =  0.42541E-03
 STANDARD ERROR OF THE ESTIMATE-SIGMA =  0.20626E-01
 SUM OF SQUARED ERRORS-SSE=  0.89337E-02
 MEAN OF DEPENDENT VARIABLE =   5.5163
 LOG OF THE LIKELIHOOD FUNCTION =  60.6972


 VARIABLE   ESTIMATED  STANDARD   T-RATIO        PARTIAL STANDARDIZED ELASTICITY
   NAME    COEFFICIENT   ERROR      21 DF   P-VALUE CORR. COEFFICIENT  AT MEANS
 LNY        0.70913     0.1597E-01   44.41     0.000 0.995     1.0513     0.9127
 LNI       -0.53319E-01 0.2140E-01  -2.492     0.021-0.478    -0.0590    -0.0169
 CONSTANT   0.57473     0.8174E-01   7.032     0.000 0.838     0.0000     0.1042

 VARIANCE-COVARIANCE MATRIX OF COEFFICIENTS
 LNY        0.25501E-03
 LNI       -0.30589E-03  0.45775E-03
 CONSTANT -0.12761E-02  0.13720E-02  0.66807E-02
              LNY           LNI           CONSTANT
 |_ end
```

b) i) Yhat = exp(0.57473+0.70913*ln(1000)-0.053319*ln(12)) = 208.67
   ii) Yhat = exp(0.57473+0.70913*ln(2000)-0.053319*ln(6)) = 353.97
   The predictions are higher as expected since this is an upward biased estimator.

c) Partial M/partial Y = alpha2*(M/Y) = 0.70913*(269.71/1443.6) = 0.1325, just slightly less than value from 9.3.

Partial M/partial i = alpha3*(i/Y) = -0.053319*(269.71/6.3293) = -2.2721, slightly smaller that value from 9.3.