Key to Midterm Exam

1. (15 Points) Calculate the GDP of KingLand, a fictitious economy whose numbers are listed below. Do so using all three methods (value added approach, income approach, and expenditure approach). Please do indicate your calculations clearly.

KingLand, year 2010

<table>
<thead>
<tr>
<th>Farmer King, (private firm)</th>
<th>KingFoodCo, Inc</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn Sold to Govt</td>
<td>$30</td>
</tr>
<tr>
<td>Corn Sold to Singapore</td>
<td>$25</td>
</tr>
<tr>
<td>Corn Sold to KingFoodCo, Inc</td>
<td>$20</td>
</tr>
<tr>
<td>Bought pesticides from Egypt</td>
<td>$10</td>
</tr>
<tr>
<td>Payment to workers</td>
<td>$40</td>
</tr>
<tr>
<td>Tax on profit</td>
<td>$15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Govt</th>
<th>Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taxes</td>
<td>$50</td>
</tr>
<tr>
<td>Purchase of Corn</td>
<td>$30</td>
</tr>
<tr>
<td>Purchase of Corn Flakes</td>
<td>$20</td>
</tr>
<tr>
<td>Unemployment benefits Paid</td>
<td>$15</td>
</tr>
</tbody>
</table>

Value-added Approach: 

\[ (30+25+20-10) + (100+20-[20-5]-10) = 160 \]

Expenditure Approach: 

\[ 100 + 5 + 50 + 15 + (X-M) = 160 \]

Income Approach: 

\[ (40+20) + (10+60) + (15+15) = 160 \]

Grading: 5 points each
2. (15 Points) Suppose that the following equations describe the a simple Keynesian macroeconomy.

\[ C = 45 + 0.9(Y - T) ; \quad T = 50 + \left( \frac{1}{9} \right)Y ; \quad I = 2500 ; \quad G = 500 + (0.1)Y \]

Find the multiplier and equilibrium GDP, and determine whether the economy incurs budget deficit or surplus?

One may find the multiplier from income-expenditure equality.

\[ Y = 45 + 0.9 \frac{2500 + 500 + (0.1)Y}{1} \Rightarrow \]
\[ Y = 3000 + 0.9 \frac{3000}{1} (0.1)Y \Rightarrow \]
\[ Y = 3000 + (0.9)Y \Rightarrow \]
\[ Y - (0.9)Y = 3000 \Rightarrow \]
\[ (0.10)Y = 3000 \Rightarrow \]
\[ Y = \frac{3000}{(0.1)} = 30000 \]

Multiplier is \( \alpha = 10 \) and equilibrium income is \( Y^* = 30000 \)

Budget surplus is \( BS = \frac{1}{9} 30000 + 50 - 500 = \frac{1}{9} 30000 = -117 \).

There is deficit.
3. (15 Points) Suppose that a macro aggregates of an economy are given as follows: 
\[
C = 500 + (0.9)(Y - T), \quad T = 500 + \left(\frac{1}{9}\right)Y, \quad I = 2500 - 1000 \cdot i, \quad G = 2000.
\]
\[
M^d = 3000 + (0.1) \cdot Y - (5000) \cdot i, \quad \frac{M^s}{P} = 4000 \text{ ve } P = 1.
\]
Solving the model yields:
(a) IS equation: 
\[
i = \frac{22750}{5000} - \frac{1}{5000} Y
\]
(b) LM equation: 
\[
i = \frac{0.1}{5000} Y - \frac{1000}{5000}
\]
(c) Equilibrium interest rate and GDP are \(i_0^* = 0.2318\) and \(Y_0^* = 21590.9\), respectively.

Notably, there is budget deficit: 
\[
BD = G - T = 2000 - 500 - \left(\frac{1}{9}\right)Y_0^* = 898.98.
\]
Turkish government would like to decrease the deficit but does not like the idea of a fall in GDP. Finally, they decided to follow a mixed policy. As a first step, government spending is decreased by 10 percent (that is, from 2000 to 1800).

(a) **Find and illustrate** the impact of this change in the IS-LM framework by solving the model numerically (assume that model economy was at given equilibrium initially).

A decrease in government spending by 200 has direct impact on IS equation:

\[
Y = 500 + (0.9) \left\{ Y - \left[ 500 + \left(\frac{1}{9}\right)Y \right] \right\} + 2500 - 1000 \cdot i + 1800 \rightarrow
\]
\[
Y = 4800 + (0.9) \left\{ Y - 500 - \left(\frac{1}{9}\right)Y \right\} - 1000 \cdot i \rightarrow
\]
\[
Y = 4800 + (0.8)Y - 450 - 1000 \cdot i \rightarrow
\]
\[
Y - (0.8)Y = 4350 - 1000 \cdot i \rightarrow
\]
\[
(0.2)Y = 4350 - 1000 \cdot i \rightarrow
\]
\[
Y = \frac{4350}{0.2} - \frac{1000}{0.2} \cdot i \rightarrow
\]
\[
Y = 21750 - 5000 \cdot i
\]

The IS equation would shift to left. Initially, if the LM is unchanged, then the new equilibrium would be

\[
i = \frac{0.1}{5000} \left\{ \frac{4350}{0.2} - \frac{1000}{0.2} \cdot i \right\} - \frac{1000}{5000} \rightarrow
\]
\[
i = \frac{4350}{1000} - \frac{1000}{1000} \cdot i - \frac{1000}{5000} \rightarrow
\]
\[
i = \frac{1}{1.1} \cdot i = 0.235 \rightarrow
\]
\[
i^*_1 = 0.2136 \text{ and } Y^*_1 = 20681.81 \text{ olarak bulunacaktır.}
\]

A 10% decrease in government spending led to approximately 4.2% decrease in GDP. The multiplier effect is \(\frac{909.9}{200} = \frac{5}{1.1} < 5\) olduğunu göstermektedir. One source of this result is de-crowding out effect, that is, inducement of private investment due to decreasing interest rate.
(b) As part of mixed policy, suppose now that money supply is increased by 25% percent, from 4000 to 5000). Find and illustrate the impact of this mixed policy on equilibrium GDP and interest rate and illustrate changes in money market and goods market.

\[ 5000 = 3000 + (0,1)Y - 5000i \rightarrow \]
\[ 2000 = (0,1)Y - 5000i \rightarrow \]
\[ 5000i = (0,1)Y - 2000 \rightarrow \]
\[ i = \frac{0.1}{5000} Y - \frac{2000}{5000} \]

By using the new LM equation and IS equation, we may easily calculate the equilibrium interest rate and GDP:

\[
\begin{align*}
  i &= \frac{0.1}{5000} \left( \frac{4350}{0.2} - \frac{1000}{0.2} \cdot i \right) - \frac{2000}{5000} \rightarrow \\
  i &= \frac{4350}{10000} - \frac{1000}{10000} \cdot i - \frac{2000}{5000} \rightarrow \\
  (1,1) \cdot i &= 0.035 \rightarrow \\
  i^*_1 &= 0.0318 \text{ ve } Y^*_1 = 21590.9 \text{ olarak bulunacaktır. Bu durumda para talebi denklemi } \\
  M_0^d &= 3000 + (0,1) \cdot 21590.9 - (5000) \cdot i \rightarrow M_0^d = 5159.09 - (5000) \cdot i \text{ olacaktır.} 
\end{align*}
\]
4. (15 Points) Suppose that Turkish government decided to decrease taxes due to forthcoming elections the next year. Using the AS-AD setup (i.e., price is variable), discuss and illustrate the effects of this change on the position of the AD, AS, IS, and LM curves and on output, the interest rate, and the price level in the short run and long-run. Assume that the economy was initially at the natural level of output.

IS right, AD right, SRAS up, LM left, Y same, i higher, P up
5. (10 Points) Suppose that the firm’s markup over costs is 5%, and the wage-setting equation is \( W = P(1 - u^2 + z) \), where \( u \) is the unemployment rate and \( z \) is the catch-all variable that stands for all other variables that may affect the wage setting equation.

(a) What is the real wage as determined by the price-setting equation?
(b) What is the natural rate of unemployment if \( z = 0.04 \)?
(c) Suppose that markup increases to 10%. How does the real wage and natural rate of unemployment change? **Support your answer by a figure.**

a. \( W/P = 1/(1+\mu) = 1/1.05 = 0.9523 \)

b. From the wage setting relation, \( u_n^2 = 1.04 - 0.9523 \Rightarrow u_n \approx 0.30 \)

c. When markup rate increases, real wage rate decreases. In particular, it becomes \( W/P = 0.9090 \). We expect that the natural rate of unemployment rises: \( u_n^2 = 1.04 - 0.9090 \Rightarrow u_n \approx 0.36 \).
6. (10 Points) Consider the following IS-LM model:

\[ C = 400 + 0.75YD \; ; \; T = 400 + (0.2) \cdot Y \; ; \; I = 300 - 1500 \cdot i \; ; \; G = 600 \; ; \; P = 0.5 \]

\[ M^d = 3 \cdot Y - 12000 \cdot i \; (\text{real money demand}) ; \; M^s = 3000 \; (\text{nominal money supply}) \]

(a) Derive the IS equation.

(b) Derive the LM equation.

(c) Find the equilibrium Y and i.

(a) One may find IS equation from income-expenditure equality.

\[ Y = 400 + 0.75Y - 400 - 0.2Y \]

\[ Y = 1000 + 0.6Y - 1500 \cdot i \Rightarrow \]

\[ (0.4) \cdot Y = 1000 - 1500i \Rightarrow \]

\[ i = \frac{1000}{1500} - \frac{0.4}{1500} Y \; \; \; \; \text{This is IS equation} \]

(b) LM equation can be derived from the money market.

\[ 6000 = 3 \cdot Y - 12000 \cdot i \Rightarrow \]

\[ 12000 \cdot i = 3 \cdot Y - 6000 \Rightarrow \]

\[ i = \frac{3}{12000} Y - \frac{6000}{12000} \; \; \; \text{This is LM equation} \]

(c) Equilibrium income and interest rate can be found via LM and IS equations.

\[ \frac{1000}{1500} - \frac{0.4}{1500} Y = \frac{3}{12000} Y - \frac{6000}{12000} \Rightarrow \]

\[ \frac{1000}{1500} + \frac{6000}{12000} = \frac{3}{12000} Y + \frac{0.4}{1500} Y \Rightarrow \]

\[ \frac{8000 + 6000}{12000} = \frac{6.2}{12000} Y \Rightarrow \]

\[ Y^* = 2258.06 \]

\[ i^* = 0.0645 \; (=6.45\%) \]
7. **(20 Points)** Suppose the Phillips curve is

\[ \pi_t - \pi_t^e = 0.05 - 2u_t \]

Where \( \pi_t^e = \pi_{t-1} \)

(i) What is the natural rate of unemployment?
(ii) Suppose that you are given the following information:

<table>
<thead>
<tr>
<th>Time (t)</th>
<th>Unemployment rate (u)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.01</td>
</tr>
<tr>
<td>2</td>
<td>0.02</td>
</tr>
<tr>
<td>3</td>
<td>0.025</td>
</tr>
<tr>
<td>4</td>
<td>0.025</td>
</tr>
</tbody>
</table>

Graph the short-run and the long-run relationship between inflation and unemployment, if \( \pi_0 = 0.05 \).

(i) At natural rate of unemployment, \( \pi_t = \pi_t^e \Rightarrow \)

\[ 0.05 - 2u_n = 0 \Rightarrow u_n = 0.025 \] (\( u_n \) is 2.5%)

(ii) Let us re-write Phillips Equation as \( \pi_t - \pi_t^e = -2(u_t - 0.025) \). We know that \( \pi_t^e = \pi_0 = 0.05 \). Using this information,

\[ \pi_1 - 0.05 = -2(0.01 - 0.025) \Rightarrow \pi_1 = 0.08 \]
\[ \pi_2 - 0.08 = -2(0.02 - 0.025) \Rightarrow \pi_1 = 0.09 \]
\[ \pi_1 - 0.09 = -2(0.025 - 0.025) \Rightarrow \pi_1 = 0.09 \]
\[ \pi^c = 0.09 \]
\[ \pi^s = 0.08 \]
\[ \pi^c = 0.05 \]

LRPC

SRPC_1

SRPC_0

\( u = 0.025 \)

\( u_1 = 0.01 \)

\( u_2 = 0.02 \)