ECO 352 – International Trade – Spring Term 2010
SAMPLE FINAL EXAMINATION
ANSWER KEY

Note: The length of the answers to Questions 1 and 2 below will serve as a guide to how much is expected for any similar questions on the actual exam. But this is only a rough guide; you should judge what is needed for each specific question.

QUESTION 1: 20 points (4 for each part)

True/false/uncertain. (The labeling False versus Uncertain is not so important. So long as you have the correct explanation, you get the points.)

(a) False. Even if all consumers have the same preferences (same utility function), their incomes can rise or fall after trade, and their budget lines can shift out or in, so they may gain or lose. For example, in the specific factors model, the factor specific to the export sector gains, the factor specific to the import-competing sector loses, and the intersectorally mobile factor may gain or lose depending on the preferences.

(b) False. As Krugman points out in his critique of the concept of national competitiveness, nations differ from corporations in that nations do not take the prices of non-tradeable factors of production (primarily labor) as given. If a country has low productivity on average across industries, its wage rate will be correspondingly lower. It will still have a cost advantage in those sectors where its productivity disadvantage is less than its wage advantage; in fact this balance is nothing other than the economic concept of comparative advantage. A mistaken obsession with national competitiveness will lead to the adoption of policies that will lower the nation's economic welfare.

(c) Uncertain. Increasing returns to scale lower average costs and therefore create a potential gain for all consumers. It is possible that one country loses if another country achieves a monopoly.

(d) False. In a competitive industry, tariffs and quotas that generate the same volume of imports will raise the domestic price by the same amount. But the effects of quotas on welfare may depend on how the quota rights are allocated: whether given away for foreign firms or foreign governments, or auctioned, or assigned to domestic producers on the basis of how much they produce, etc. Moreover, if the domestic industry is a monopoly, it will face a less elastic residual demand curve under a quota than under a tariff, and will therefore charge a higher price.

(e) False. First, it is not feasible to “favor [all] domestic producers.” An overvalued exchange rate favors domestic producers of non-tradeables and disfavors domestic producers of tradeables (both export and import-competing sectors). As a matter of fact, the opposite strategy of an undervalued real exchange rate, favoring tradeables over non-tradeables, has generally proved more successful.

QUESTION 2: 30 points (10 for each part), 45 minutes

(a) The essential idea in Culbertson's statement is “factor price equalization” (FPE). The assertion is that in advanced countries, trade means importing relatively high-labor-intensity goods, and therefore importing labor by proxy. This has the same effect of lowering wages as immigration which

would increase labor supply directly. (The key is to recognize the significance of the phrase “which has the same effect”. You can talk all around the effects of trade and migration separately, but if you don't recognize and discuss the connection – the FPE concept – you don't get many points.) While FPE is valid in the Heckscher-Ohlin model of two goods, two factors, and incomplete specialization, in other models it is at best partially valid in the sense that trade in goods may create a tendency toward FPE. The existence of (sector-)specific factors of production, cross-country differences in technologies, all destroy the factor-price equalization result. And as a matter of reality it is far from being true, as we see from the large and persistent real wage differences between countries that trade quite freely in goods and services. Also, the question of how large an effect immigration would have on wages is highly debatable. Finally, it is not true that “no one supports the notion of free immigration”. Owners of complementary factors – capital and skilled labor – benefit from an inflow of low-skilled labor, and often support more immigration of this kind.

(b) The issue can be analyzed within the standard model of international trade by considering trade between goods at different dates. The relative price is the marginal rate at which present goods can be transformed / are willingly substituted into future goods, i.e. 1 plus the rate of interest. Capital will flow from country A to country B if A's autarkic rate of interest is less than B's. Lucas' assertion is that if A is richer than B, the marginal product of capital and therefore the autarkic rate of interest must be higher in B. This need not happen for various reasons. Two we considered in class are: [1] If A is more impatient than B, then consumers in A are willing to give up a unit of present goods only in return for a large quantity of future goods, so the rate of interest is higher. [2] If the institutions of property right protection and contract enforcement in B are defective, then the marginal product of capital is not in fact high. (Lucas emphasizes that poor countries have low levels of human capital, which reduces the marginal product of physical capital, but that is going beyond his original statement.)

(c) This is a question of trade creation versus trade diversion; little credit is given if you don't recognize this and just give some generalities about NAFTA being good or bad. A simple effective way to answer the question would be to modify the numerical example that was given in class to explain the concepts of trade creation and trade diversion, but a verbal answer would suffice.

If the US is the lower-cost producer of the tractors and similar equipment, then NAFTA will be trade-creating, and will benefit the US (higher producer surplus) and Mexico (higher consumer surplus), although it may inflict some losses of surplus on Japanese producers if their supply curve is upward-sloping.

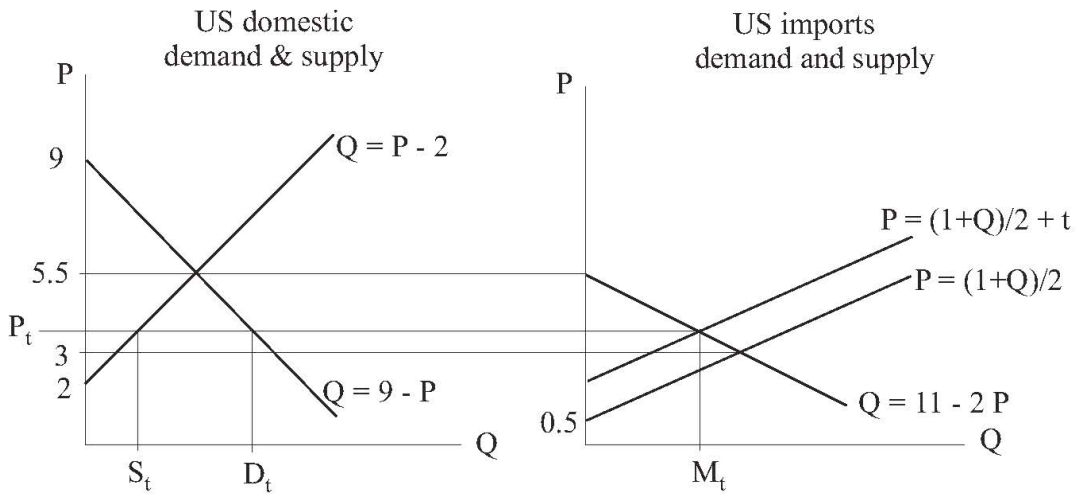
If Japan is the lower-cost producer and would be displaced partially or totally in the Mexican market by the preferential entry of US producers, this will be trade diversion. Mexico would be mainly the loser (loss of tariff revenue would exceed consumer surplus gains). The US may gain producer surplus and Japan may lose it if they have upward-sloping supply curves, but the world as a whole would surely lose because production is now allocated less efficiently.

Other issues of oligopoly and strategic trade policy can be mentioned, but the trade creation and diversion distinction is crucial in answering this question.

QUESTION 3: 25 points, 40 minutes

The figure shows the relevant demand and supply curves. The US demand curve for imports is obtained by horizontal subtraction of US supply from US demand:

$$Q = (9 - P) - (P - 2) = 11 - 2P, \quad \text{or} \quad P = (11 - Q)/2 = 5.5 - Q/2$$



(a) (2 points) If imports are banned, the US market must clear, so $P - 2 = 9 - P$, or $2P = 11$, or $P = 5.5$.

(b) (i) (2 points) If Netbooks can be imported freely into the US, the import market must clear with
$2P - 1 = 11 - 2P$, or $4P = 12$.
Therefore the equilibrium price of Netbooks in the US market will be 3.

(ii) (2 points) Quantity consumed = 9 – 3 = 6; quantity produced = 3 – 2 = 1;
quantity imported = 6 – 1 = 2 * 3 – 1 = 5.

(iii) (2 points) Consumer surplus = ½ (9–3) * 6 = 18, producer surplus = ½ (3–2) * 1 = 0.5,
total surplus = 18.5 .

(c) The tariff shifts the supply curve of imported Netbooks in the US market vertically up by t. If $t < 5$, there is an equilibrium with positive imports; if $t > 5$ the tariff is prohibitive and the US market must clear in autarky. (Mechanically solving the equations would yield a negative solution for imports; this may make some think that the country would become an exporter. That is false. A tax on imports does not create any incentive to export.)

In the following, it is perfectly OK to do separate numerical calculation for each tariff level t= 2, 4. But it is actually easier to do the calculation algebraically for general t, which also prepares for part (d).

For $t < 5$, equilibrium requires $(1+Q)/2 + t = (11-Q)/2$, or $t = (11-Q-1-Q)/2 = (10-2Q)/2 = 5 - Q$.
Therefore $Q = 5 - t$, and then $P = (11 - 5 + t)/2 = 3 + t/2$.
For $t > 5$, we have $P = 5.5$ as in part (a).

(i) (3 points) When $t = 2$, $P = 4$; when $t = 4$, $P = 5$; when $t = 6$, $P = 5.5$

(ii) (3 points) Write D for domestic consumption, S for domestic production, and M for imports.
For $t = 2$, $D = 5$, $S = 2$, $M = 3$.
For $t = 4$, $D = 4$, $S = 3$, $M = 1$.
For $t = 6$, $D = S = 3.5$, $M = 0$.

(iii) (3 points) For $t = 2$, consumer surplus = $\frac{1}{2}(9–4) * 5 = 12.5$, producer surplus = $\frac{1}{2}(4–2) * 2 = 2$, tariff revenue = $2 * 3 = 6$, total surplus = 20.5 .
For $t = 4$, consumer surplus = $\frac{1}{2}(9–5) * 4 = 8$, producer surplus = $\frac{1}{2}(5–2) * 3 = 4.5$, tariff revenue = $4 * 1 = 4$, total surplus = 16.5 .

(iv) (3 points) The total social surplus for tariff $t = 2$ is greater than that under free trade. The improvement in the terms of trade (price which the US pays to the rest of the world is now $4 – 2 = 2$, less than the 3 under free trade) is responsible for this.

The total social surplus for tariff rate $t = 4$ is less than that under free trade. Although the terms of trade continue to improve, the volume of trade shrinks too much. The US has overshot its optimal monpsony tariff.

(d) (5 points) For a tariff rate $t < 5$, the US price is $P_t = 3 + t/2$. Then
domestic supply $S_t = 3 + t/2 – 1 = 1 + t/2$
domestic consumption $D_t = 9 – (3 + t/2) = 6 – t/2$
import quantity $M_t = D_t – S_t = 5 – t$
Consumer surplus = $\frac{1}{2}(9 – 3 – t/2)(6 – t/2) = \frac{1}{2}(6 – t/2)^2$
Producer surplus = $\frac{1}{2}(3 + t/2 – 2)(1+t/2) = \frac{1}{2}(1+t/2)^2$
Tariff revenue = $t(5 – t)$
Total surplus = $\frac{1}{2}(36 – 6t + t^2/4) + \frac{1}{2}(1+t+t^2/4) + 5t – t^2$
$= 18.5 + 2.5t – 3t^2/4$
To maximize this, the first-order condition is $2.5 – 3t/2 = 0$, therefore $t = 5/3$.

(Extra information, not required in your answer: So actually even $t = 2$ was too high, but it was still better than $t = 0$.)

QUESTION 4: (25 points)

(a) (i) (1 point) Profit expressions:

$$\begin{aligned}\Pi_S &= [\,P_S - (80 + T_S)\,]\,[\,(400 - \tfrac{1}{2}\,P_H) - P_S\,] \\ \Pi_H &= [\,P_H - 80\,]\,[\,(400 - \tfrac{1}{2}\,P_S) - P_H\,]\end{aligned}$$

(ii) (4 points) Using the result given in the statement of the question, Π_S is maximized when

$$P_S = \frac{(80 + T_S) + (400 - \frac{1}{2}\,P_H)}{2} = 240 + \tfrac{1}{2}\,T_S - \tfrac{1}{4}\,P_H\,.$$

Similarly, Π_H is maximized when

$$P_H = \frac{80 + (400 - \frac{1}{2}\,P_S)}{2} = 240 - \tfrac{1}{4}\,P_S\,.$$

(iii) (2 points) Solving

$$P_S = 240 + \tfrac{1}{2}\,T_S - \tfrac{1}{4}\,(240 - \tfrac{1}{4}\,P_S) = 240 - 60 + \tfrac{1}{2}\,T_S + \tfrac{1}{16}\,P_S\,,$$

or

$$\tfrac{15}{16}\;P_S = 180 + \tfrac{1}{2}\,T_S\,,$$

or

$$P_S = \frac{16 \times 180}{15} + \frac{16}{15 \times 2}\;T_S = 192 + \tfrac{8}{15}\;T_S\,.$$

Then

$$P_H = 240 - \tfrac{1}{4}\;\left[192 + \tfrac{8}{15}\;T_S\right] = 240 - 48 - \tfrac{2}{15}\,T_S = 192 - \tfrac{2}{15}\,T_S\,.$$

(iv) (3 points) Substituting,

$$\begin{aligned}Q_S &= 400 - \tfrac{1}{2}\;\left[192 - \tfrac{2}{15}\,T_S\right] - \left[192 + \tfrac{8}{15}\,T_S\right] = 112 - \tfrac{7}{15}\,T_S \\ Q_H &= 400 - \left[192 - \tfrac{2}{15}\,T_S\right] - \tfrac{1}{2}\;\left[192 + \tfrac{8}{15}\,T_S\right] = 112 - \tfrac{2}{15}\,T_S\end{aligned}$$

and

$$\begin{aligned}\Pi_S &= [\,192 + \tfrac{8}{15}\;T_S - (80 + T_S)\,]\;(112 - \tfrac{7}{15}\,T_S) = (112 - \tfrac{7}{15}\,T_S)^2\,, \\ \Pi_H &= [\,192 - \tfrac{2}{15}\,T_S - 80\,]\;(112 - \tfrac{2}{15}\,T_S) = (112 - \tfrac{2}{15}\,T_S)^2\,.\end{aligned}$$

(b) (i) (2 points) When $T_S = 0$,

$$P_S = P_H = 192, \quad Q_S = Q_H = 112, \qquad \Pi_S = \Pi_H = 112^2 = 12544\,.$$

The Indian and Chinese surpluses equal the respective firms' profits, so 12544 each.

(ii) (5 points) The Indian government wants to maximize

$$\begin{aligned}
W_{India} &= \Pi_S + T_S\, Q_S = (P_S - 80 - T_S)\, Q_S + T_S\, Q_S = (P_S - 80)\, Q_S \\
&= \left[192 + \tfrac{8}{15}\, T_S - 80\right]\, (112 - \tfrac{7}{15}\, T_S) \\
&= (112 + \tfrac{8}{15}\, T_S)\, (112 - \tfrac{7}{15}\, T_S) \\
&= 112^2 + 112\, (\tfrac{8}{15} - \tfrac{7}{15})\, T_S - \tfrac{7}{15}\, \tfrac{8}{15}\, (T_S)^2 \\
&= 12544 + \tfrac{112}{15}\, T_S - \tfrac{56}{15\times 15}\, (T_S)^2
\end{aligned}$$

The first-order condition is

$$\tfrac{112}{15} - \tfrac{56}{15\times 15}\, 2\, T_S = 0\,.$$

The second-order condition is

$$-2\, \tfrac{56}{15\times 15} < 0\,,$$

which is true. Solving the first-order condition, the optimal subsidy is

$$T_S = \frac{112 \times 15 \times 15}{2 \times 56 \times 15} = 15\,.$$

So the Indian government's optimal strategic policy is an export tax of 15 per unit of software.

(iii) (2 points) With $T_S = 15$, we have

$$P_S = 192 + 8 = 200,\ P_H = 192 - 2 = 190,\ Q_S = 112 - 7 = 105,\ Q_H = 112 - 2 = 110\,,$$

and

$$W_{India} = (112 + \tfrac{8}{15}\, 15)\, (112 - \tfrac{7}{15}\, 15) = 120 \times 105 = 12600,$$
$$W_{China} = \Pi_H = (112 - \tfrac{2}{15}\, 15)^2 = 110^2 = 12100\,.$$

The Indian surplus is higher than it would be without the policy, and the Chinese surplus (Denovo's profit) is lower.

(iv) (6 points) In the quantity-setting (Cournot) duopoly of Problem Set 6, EU's optimal strategic policy was an export subsidy. This increased Airbus's sales and lowered Boeing's. The EU surplus was higher, and the US surplus (Boeing's profit) was lower, than they would be in the absence of the policy. Here India's optimal strategic policy is an export tax.

In Problem Set 6, Airbus benefits if Boeing offers a smaller quantity for sale. EU's strategic subsidy achieves this outcome by shifting out Airbus's best response function and driving Boeing down its best response function. With price-setting and complementary products, Programagica benefits if Denovo charges a lower price (because that shifts Programagica's demand curve to the right; this is because the products are complements). Denovo's best response function in prices is downward-sloping. Therefore the way for the Indian government to get Denovo to charge a lower price is to commit Programagica to charging a higher price, which is done by shifting its price best-response function outward by means of the export tax. To induce Denovo to charge a lower price, Programagica must raise its price by a lot (4:1 ratio along the best response curve). This reduces Denovo's sale because the products are complements. With a lower price and lower sales, Denovo's profit goes down.