Answer Key: Homework Assignment #4

1. a. Conceptually the difference lies in the how a consumer can change his or her behavior in the short versus the long run. In the case of gasoline the difference is usually in the choice of car or vehicle. In the short run the consumer can not change the vehicle which he/she drives however in the long run the consumer may switch to a more fuel efficient form of transport when the car is no longer useable.
   b. Consumers can switch to more fuel efficient forms of transport in the long run compared to the short run.
   c. The government could offer payments to car owners who scrapped cars older than 8 years or any other method to switch to newer cars. They could increase subsidies for mass transit. They could provide incentives for living closer to work. They could provide incentives to engage in oil exploration. They could increase the exemption for moving expenses in cases where this reduces a commute.

2. a. The Iraq War began on March 20, 2003. According to the U.S. Energy Information Administration (http://tonto.eia.doe.gov/dnav/pet/hist/wtotworldw.htm), average world crude oil prices were $31.71 per barrel on 3/7/03 and $31.68 on 3/14/03. Also according to EIA (http://www.eia.doe.gov/emeu/international/oilproduction.html), world daily oil production was 69.313 mbd in February 2003. I think you will find these numbers close to those in the problems below.
   b. Set $Q_D = Q_S$ ===> 85 - .3P = 76 ===> 9 = .3P ===> P = 30, Q = 76
   c. Using algebra method: price elasticity of demand = % change Q_D/ % change P.
   Need to use midpoint method, so if P = 31, Q_D = 85 - .3(31) = 75.7, if P = 29, Q_D = 85 - .3(29) = 76.3. % change Q_D = (76.3 - 75.7)/76 = .0079. % change P = (29 - 31)/30 = -.0667.
   Price elasticity of demand = .0079/-.0667 = 0.1184 (inelastic)
   Using calculus method = $\partial Q_D/\partial P$ (P/Q) = -.3(30/76) = 0.1184

   Price elasticity of supply = % change Q_S/ % change P.
   Using midpoint method if P = 31, Q_S = 76, if P = 29, Q_S = 76.
   % change Q_S = (76 - 76)/76 = 0. % change P = (29 - 31)/30 = -.0667.
   Price elasticity of demand = 0/-.0667 = 0 (perfectly inelastic)
   Using calculus method = $\partial Q_S/\partial P$ (P/Q) = 0(30/76) = 0

   d. Now Q_S = 73. Set $Q_D = Q_S$ ===> 85 - .3P = 73 ===> 12 = .3P ===> P = 40, Q = 73
   e. Set $Q_D = Q_S$ ===> 85 - .3P = 70 + .2P ===> 15 = .5P ===> P = 30, Q = 76
   Price elasticity of supply = % change Q_S/ % change P.
   Using midpoint method if P = 31, Q_S = 70 + .2(31) = 76.2, if P = 29, Q_S = 70 + .2(29) = 75.8
   % change Q_S = (75.8 - 76.2)/76 = -0.0053, % change P = (29 - 31)/30 = -.0667.
   Price elasticity of supply = -.0053/-.0667 = 0.0789 (inelastic)
   Using calculus method = $\partial Q_S/\partial P$ (P/Q) = .2(30/76) = 0.0789
   f. Now Q_S = 67 + .2P. Set $Q_D = Q_S$ ===> 85 - .3P = 67 + .2P ===> 18 = .5P ===> P = 36, Q = 74.2
   Notice that some (but not all) of the effect of the war is mitigated by other oil producing countries increasing their production in the wake of the reduction in Iraq's output.

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3. a. An negative shock to oil supplies will increase the price of oil leading to an increase in the demand for natural gas since they are substitutes. In the absence of any price or supply controls, this is a simple rightward shift in the demand curve leading to an increase in both the price and equilibrium quantity. The price of imported gas will rise in the same way that the price of domestic gas will rise. It is not possible to tell whether imports will rise or fall based on the information given.
   b. Now there is a price ceiling on domestic field prices. Any production above the level at the price ceiling must be met by imported natural gas. Thus, as excess demand is met by imports, retail prices rise despite the imposition of a price ceiling. Domestic field prices are unchanged, import prices rise, retail prices rise.
   c. Here supply is perfectly inelastic. If there is a price ceiling in place, price remains unchanged, and the market faces shortages. If there is no price ceiling in place, price rises until equilibrium quantity meets the constrained supply. Imports are similarly constrained, so they cannot help the situation.

4. a. $Q_D = Q_S$ ===> 85 - .3P = (35 + .1P) + (35 + .1P) ===> 15 = .5P ===> P = 30
   Q_{cartel} = 38, TR = PQ = 38(30) = 1,140, Q_{ROW} = 38, TR = PQ = 38(30) = 1,140

   b. $Q_D = Q_S$ ===> 85 - .3P = (35 + .1P) + (20) ===> 30 = .4P ===> P = 75
   Q_{cartel} = 20, TR = PQ = 75(20) = 1,500, Q_{ROW} = 35 + .1(75) = 42.5, TR = PQ = 42.5(75) = 3,187.5

   c. $Q_D = Q_S$ ===> 97 - .7P = (35 + .1P) + (35 + .1P) ===> 27 = .9P ===> P = 30
   Q_{cartel} = 35 + .1(30) = 38, TR = PQ = 38(30) = 1,140, Q_{ROW} = 38, TR = PQ = 38(30) = 1,140

   d. $Q_D = Q_S$ ===> 97 - .7P = (35 + .1P) + (20) ===> 42 = .8P ===> P = 52.5
   Q_{cartel} = 20, TR = PQ = 52.5(20) = 1,050
   Q_{ROW} = 35 + .1(52.5) = 40.25, TR = PQ = 52.5(40.25) = 2,113.12

   e. Cartels are more effective when the target good is inelastic. Both price elasticities of supply and demand are more inelastic in the short-run than the long-run for reasons noted in question 1. In part b. the good is clearly more inelastic than in part d., and the cartel makes an additional 360 in revenues by reducing demand in part b. while the cartel's revenue falls by 390 in part d.

   f. $Q_D = Q_S$ ===> 85 - .3P = (49 + .14P) + (21 + .06P) ===> 15 = .5P ===> P = 30
   Q_{cartel} = 21 + .06(30) = 22.8, TR = PQ = 22.8(30) = 684
   Q_{ROW} = 49 + .14(30) = 53.2, TR = PQ = 53.2(30) = 1,596

   g. $Q_D = Q_S$ ===> 85 - .3P = (49 + .14P) + 12 ===> 24 = .44P ===> P = 54.55
   Q_{cartel} = 12, TR = PQ = 12(54.55) = 654.6
   Q_{ROW} = 49 + .14(54.55) = 56.64, TR = PQ = 54.55(56.64) = 3,089.71

   85 - .3P and a supply that is controlled by two groups of unequal size: a cartel with supply equal to 21 + .06P and the rest of the market with supply equal to 49 + .14P for a total market supply of 70 + .2P.

h. Cartels are less likely to be successful when the cartel controls a smaller percentage of the market. When the cartel controlled 50% of the market (as in parts a. and b.), a roughly 50% reduction in the cartel's output increased cartel revenue by over 30%. When the cartel only controlled 30% of the market (as in parts f. and g.), a roughly 50% reduction in the cartel's output resulted in a decrease in cartel revenue. While there are several reasons the restaurant industry is not prone to cartel, the only explanation that relates to the problems at hand is the fact that with so many independent members, it would be difficult for a restaurant cartel to attract a sufficient number of members to control a large enough portion of the market to be effective.

i. Want to maximize total revenue = PQ.
$Q_D = Q_S$ ===> 85 - .3P = (35 + .1P) + Q
Q = 50 - .4P
TR = P(50 - .4P)
dTR/dP = 50 - .8P = 0 ===> P = 50/.8 = 62.5
Q = 50 - .4(62.5) = 25

Can do a partial check of your answer. If Q = 25, $Q_D = Q_S$ ===> 85 - .3P = (35 + .1P) + 25 ===> P = 62.5. TR for cartel = 62.5(25) = 1,562.5 which exceeds the total revenue in either part a. or b.

5. Again from EIA, refiner sales to retailers in January 2008 were 44,507 thousand gallons per day and were 48,032 gallons per day in June 2008. The average price of a gallon of gas was $3.095 in January and $4.105 in June.

Elasticity of demand is % change in demand/% change in price.

% change in demand = (48,032 - 44,407)/(avg. 48,032-44,507) = 0.0783
% change in price = (4.105 - 3.095)/ (avg. 3.095-4.105) = .2806
Elasticity = .0783/.2806 = .2791

The main problem use should recognize here is that the elasticity is positive not negative, so this good apparently violates the basic law of demand since quantity demanded rose as price rose rather than the other way around.

There is likely clear seasonality in effect or some other reason causing this problem. Shows the difficulty of the ceteris paribus rule in economics.