~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

# HOMEWORK 7  (for due date see the web page)

A monopolist faces $n_A$ type $A$ consumers, $n_B$ type B consumers and $n_C$ type C consumers.

Each type A consumer has the demand function $D_A(P) = 80 - P$, each type B consumer has the

demand function $D_B(P) = 80 - 2P$ and each type C consumer has the demand function

$D_B(P) = 80 - 3P$. The monopolist is considering selling the good in packages. The pair $(Q,V)$

represents a package containing $Q$ units at a total price of $V$ (thus $V$ is the price of the entire

package, not the price per unit). The monopolist's cost function is $C(q) = 4q$. The monopolist is

considering the following options.

**OPTION 1**. Sell only one type of package ($Q_1 = 30$, $V_1 = 750$)

**OPTION 2**. Sell two types of packages: ($Q_{21} = 25$, $V_{21} = 562$) and ($Q_{22} = 40$, $V_{22} = 918$).

**OPTION 3**. Sell two types of packages: ($Q_{31} = 60$, $V_{31} = 729$) and ($Q_{32} = 76$, $V_{32} = 920$).

**(a) (a.1)** Calculate the monopolist's profits for Option 1 as a function of $n_A, n_B$ and $n_C$.
**(a.2)** Evaluate the expression of part (a.1) when $n_A = 5$, $n_B = 10$ and $n_C = 15$.

**(b) (b.1)** Calculate the monopolist's profits for Option 2 as a function of $n_A, n_B$ and $n_C$.
**(b.2)** Evaluate the expression of part (b.1) when $n_A = 5$, $n_B = 10$ and $n_C = 15$.

**(c) (c.1)** Calculate the monopolist's profits for Option 3 as a function of $n_A, n_B$ and $n_C$.
**(c.2)** Evaluate the expression of part (c.1) when $n_A = 5$, $n_B = 10$ and $n_C = 15$.

**(d)** Write the maximization problem faced by the monopolist when it cannot tell types apart but knows that the numbers $n_A$, $n_B$ and $n_C$ and the demand function of each type. No need to solve the problem, just state it with all the relevant constraints.

**(e)** What would the monopolist's profits be if it were able to tell types apart and offer each type a package targeted to that type only?