Pre-semester assignment
ECON 4620

Adam Harris, Cornell University

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Instructions: Please complete this assignment before the first lecture and bring your solutions with you. This assignment will not be graded, and you do not need to submit solutions on Canvas.

1. **Microeconomics**: Consider a perfectly competitive market with inverse demand curve $P = a - bQ$ and supply curve $P = c$, where a, b, c are positive constants and $a > c$.
   (a) Find the equilibrium price and quantity.
   (b) Compute consumer and producer surplus.
   (c) Now suppose the supply curve is $P = c + dQ$ and redo parts (a) and (b).
2. **Optimization**: For each of the following problems, find the global minimum if such a minimum exists.
   (a) $\min_x \frac{1}{3}x - \log x$
   (b) $\min_{x,y} x^2 + y^2 - xy - 15x$
   (c) $\min_{x,y} 5xy - \frac{1}{2}x^2 - \log y$
3. **Coding**: In a programming language of your choice (or in pseudocode), write a function that does each of the following:
   (a) Given a natural number n, the function returns the product of all odd natural numbers less than or equal to n.
   (b) Given a natural number n, the function returns the largest Fibonacci number less than or equal to n. (The Fibonacci sequence is defined as follows: $F_0 = 1, F_1 = 1$ and for all $k > 1$, $F_k = F_{k-2} + F_{k-1}$.)
   (c) (*Challenge*) Given a real number $b \in (0, 900)$, the function returns the solution to $x^3 - x^2 = b$ on $x \in [1, 10]$.