Problem Set #1 Answer Key

Economics 435: Quantitative Methods

Fall 2011

1 Sets

1. (a) is true.
2. (a) is true. The correct statements in parts 2 and 3 of this question are known as "DeMorgan's laws".
3. (b) is true.
4. (b) is true.

2 Functions: Limits

Pick any $\delta > 0$. Take $N = \frac{1}{\delta}$ and pick any $x > N$. Since both x and N are positive, we can say that $0 < \frac{1}{x}$, and so that $|\frac{1}{x} - 0| = \frac{1}{x}$. In addition, since $x > N$, we can say that $\frac{1}{x} < \frac{1}{N} = \delta$. Therefore, for any $\delta > 0$, there exists an N such that $|\frac{1}{x} - 0| < \delta$.

If you had trouble with this, then you need to learn more about limits. Take a look at your calculus textbook. Generally the way to prove a particular limit works like the example here. You assume some δ (you don't get to pick it). Then you calculate some N that guarantees the condition will hold for $x > N$. Note that you don't have to find the smallest N that satisfies the condition.

3 Summations

1. (a) is correct. See Property Sum.1 in Appendix A of your textbook (p 695 in the 4th edition).
2. (b) is correct. See Property Sum.2 in Appendix A of your textbook (p 695 in the 4th edition).
3. (b) is correct. Remember what the summation operator is, and remember the commutative property of addition (i.e., that $a + b = b + a$).
4. (a) is correct. If this one is unclear, try it out with $n = 3$, and solve it by hand.
5. (b) is correct. Note that (a) isn't even a well-defined statement - you can't use i as the index in the second summation because it is already in use in the first summation.
6. (a) is correct because you can always switch adjacent summation operators (again, by the commutative property). Note that (b) is incorrect because you can't take a_i outside of $\sum_{j=1}^{n}$. It *would* be correct to say that $\sum_{j=1}^{n}\sum_{i=1}^{n} a_i b_j = \sum_{j=1}^{n} b_j \sum_{i=1}^{n} a_i$.

4 Functions: Slopes and elasticities

1. The slope is $\frac{dy}{dx} = \beta_1$ and the elasticity is $\frac{dy}{dx}\frac{x}{y} = \frac{\beta_1 x}{\beta_0 + \beta_1 x}$.
2. The slope is $\frac{dy}{dx} = \beta_1 + 2\beta_2 x$ and the elasticity is $\frac{dy}{dx}\frac{x}{y} = \frac{\beta_1 x + 2\beta_2 x^2}{\beta_0 + \beta_1 x + \beta_2 x^2}$.
3. The slope is $\frac{dy}{dx} = \beta_1 e^{\beta_0} x^{\beta_1 - 1}$ and the elasticity is $\frac{dy}{dx}\frac{x}{y} = \beta_1$.
4. The slope is $\frac{dy}{dx} = \beta_1 \beta_2 \left(\beta_0 + \beta_1 x\right)^{\beta_2 - 1}$ and the elasticity is $\frac{dy}{dx}\frac{x}{y} = \frac{\beta_1 \beta_2 x}{\beta_0 + \beta_1 x}$. If you had trouble with this one, be sure to review the chain rule for differentiation.

5 An introduction to R

The script should look like this:

```
print(seq(1,length=50,by=2))
rep("Brian",times=50)
sqrtOfMyID <- function(name,id) {
cat("My name is ",name,".  My student ID is ",id,", and its square root is ",sqrt(id),"\n")
}
sqrtOfMyID("Brian",4)
```