**Quiz 1, EE 303, September 3, 2017, Dr. McCalley.** Closed book, closed notes, calculator allowed, communication devices not allowed; Answer on this sheet of paper.

1. **Short-answer (48):** In a single-phase 50 Hz circuit, a voltage of 120 volts rms is imposed across a load $Z$. The resulting current through the load has an rms value of 60 amps, and that current is lagging the voltage by 90 degrees.
   a. (7) How many cycles per second does the voltage waveform have?
   **Solution:** 50
   b. (7) What is the frequency in radians per second?
   **Solution:** $\omega=2\pi f=2\pi(50)$
   c. (7) If we assign the voltage phasor as the reference ($\theta_v=0$), what is the angle of the current phasor (i.e., what is $\theta_i$)?
   **Solution:** $\theta_i=-90^\circ$
   d. (7) What is the power factor angle of this load?
   **Solution:** $\theta=90^\circ$
   e. (7) What is the power factor of this load? (indicate inductive or capacitive)
   **Solution:** $\text{pf}=\cos\theta=\cos90^\circ=0 \text{ inductive}$
   f. (7) What is the angle in the polar representation of the load $Z$?
   **Solution:** $Z=|Z|\angle\theta \Rightarrow \theta=90^\circ$
   g. (7) What are the peak-values of the voltage and current?
   **Solution:** $V_{\text{peak}}=120\sqrt{2}=169.2\text{volts}; I_{\text{peak}}=60\sqrt{2}=84.6\text{amps}$
   h. (7) What is the average value of the instantaneous power supplied to this load?
   **Solution:** 0 watts
   i. (7) Compute the real (P) and reactive (Q) power supplied to this load.
   **Solution:**
   $P=|V||I|\cos\theta=120*60\cos(90)=0$.
   $Q=|V||I|\sin\theta=120*60\sin(90)=7200\text{watts}=7.2\text{kW}$

2. **True-false (30 pts, 7 each):**
   - **F** (a) Wholesale electricity prices called LMPs are computed by ISOs once a day, and are virtually the same for every node in the network.
   - **T** (b) Today, natural gas and coal are #1 and #2 in the nation, respectively, as energy resources for generating electricity; natural gas, wind, and solar have the three largest growth rates for US energy resources for generating electricity and are the lowest cost energy resources.
   - **T** (c) Today, in the US, wind supplies over 1.8% of total energy used for all purposes and over 5.6% of electrical energy; in Iowa, wind supplies over 30% of the electrical energy.

3. **Calculation (16 pts):** If the line-to-line voltage at a load is 8660 V, what is the voltage magnitude across each phase of the load if the load is connected as follows:
   - In Wye: $|V_\phi|=$_________8660$/\sqrt{3}=5000\text{ volts}$
   - In Delta: $|V_\phi|=$_________8660 volts