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 (θ_v=0), what is the angle of the current phasor (i.e., what is θ_i)?
 Solution: θ_i=-90°
 - 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**: $pf=\cos\theta=\cos90^\circ=0$ inductive
 - f. (7) What is the angle in the polar representation of the load Z? Solution: $Z=|Z| \sqcup \theta \rightarrow \theta=90^{\circ}$
 - g. (7) What are the peak-values of the voltage and current? Solution: $V_{peak}=120\sqrt{2}=169.2$ volts; $I_{peak}=60\sqrt{2}=84.6$ 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: $P=|V||I| \cos\theta=120*60\cos(90)=0.$ $Q=|V||I| \sin\theta=120*60\sin(90)=7200watts=7.2kW$

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: $|V_{\phi}| = _____{8660/\sqrt{3}=5000}$ volts

In Delta: $|V_{\phi}| =$ _____8660 volts