ECON 180 - Regulation & Antitrust Policy
Drake University, Spring 2013
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Signature: ______________________________

Printed name: ______________________________

QUIZ 11 VERSION B
"Regulation of Electric Power"

INSTRUCTIONS: This exam is closed-book, closed-notes. Simple calculators are permitted, but graphing calculators or calculators with alphabetical keyboards are NOT permitted. Mobile phones or other wireless devices are NOT permitted. Points will be subtracted for illegible writing or incorrect rounding. Point values for each question are noted in brackets.

I. Multiple choice: Circle the one best answer to each question. [2 pts each: 28 pts total]

(1) The *rate base* for a regulated public utility is
a. the monthly service fee for its lowest-price customers.
b. the number of customers it serves.
c. the minimum usage price it may charge.
d. the value of its plant and equipment.

(2) The Averch-Johnson effect is the hypothesis that a utility subject to traditional rate-of-return regulation will
a. pay unionized workers a wage higher than the competitive wage.
b. let expenses rise above that of a competitive firm.
c. overinvest in physical capital.
d. allow plant and equipment to deteriorate.

(3) Regulatory lag ____________ the utility's incentives to minimize cost.
a. completely eliminates.
b. has no effect on.
c. decreases.
d. increases.

(4) Under price-cap regulation, the utility's prices are set
a. to cover the utility's expenses plus an allowed rate of return on the rate base.
b. to match the price of hats.
c. to match those of its competitors.
d. to increase with the rate of inflation, less adjustments for industry productivity growth.

(5) Shared costs are allocated among products in proportion to output quantities, according to the method of
a. fully-distributed costs.
b. two-part tariffs.
c. Ramsey pricing.
d. peak-load pricing.

(6) According to Kahn's definition, the cost of an input that can be used to produce both of two outputs, where the amount needed depends on the maximum of the two outputs, is called
a. an average cost.
b. a fixed cost.
c. a common cost.
d. a joint cost.
e. a fully-distributed cost.

(7) In practice, simple time-of-use pricing of electricity ignores fluctuations in short-run marginal cost due to
a. unpredictable heat waves and generator outages.
b. predictable seasonal changes in demand.
c. predictable daily changes in demand.
d. all of the above.

(8) The most important barrier to peak-load pricing in electric power in practice is that
a. the relevant economic theory is not yet developed.
b. not enough electric power is available.
c. sophisticated usage meters are not available.
d. demand for power fluctuates during the day and over the year.

(9) Wholesale markets for electricity are regulated by
a. local governments.
b. state utility commissions.
c. the Federal Trade Commission.
d. the Federal Energy Regulatory Commission.

(10) To sell electricity in wholesale markets, an electricity producer must
a. be regulated by a state commission.
b. have retail customers.
c. be owned by a local government.
d. all of the above.
e. none of the above.

(11) In wholesale electricity markets that use "pay as bid" pricing, each supplier's optimal bid is usually
a. less than its true marginal cost.
b. equal to its true marginal cost.
c. greater than its true marginal cost.
d. zero.

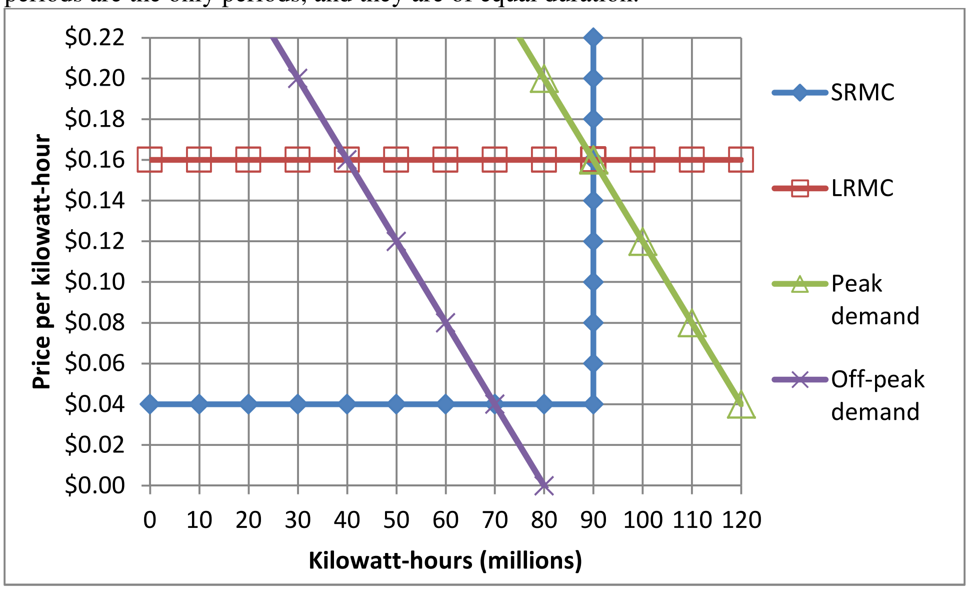
(12) If there is *no* transmission congestion in a large regional wholesale electricity market, then suppliers at different locations
a. receive prices that depend on local supply.
b. receive prices that depend on local demand.
c. both (a) and (b).
d. receive the same price everywhere.

(13) The short-run wholesale electricity supply curve look like a
a. hockey stick.
b. hula-hoop.
c. baseball bat.
d. tennis racket.

(14) Spot prices for wholesale electricity are volatile during peak periods because wholesale
a. demand is price-elastic but supply is inelastic.
b. supply is price-elastic but demand is inelastic.
c. demand and supply are both price-inelastic.
d. demand and supply are both price-elastic.

II. Problems: Insert your answer to each question below in the box provided. Use the margins and graphs for scratch work—only the answers in the boxes will be graded. Work carefully—partial credit is not normally given for questions in this section.

(1) [Peak-load pricing: 33 pts] Suppose cost and demand for electricity are given by the following graph. Costs are shown as short-run marginal cost (SRMC) and long-run marginal cost (LRMC) curves. LRMC includes the cost of building new capacity. Demands are shown as peak demand and off-peak demand. Assume for simplicity that peak and off-peak periods are the only periods, and they are of equal duration.



a. Explain in words why SRMC bends up vertically at 90 million kilowatt hours.

First, suppose efficient peak-load pricing is used.

b. Find the price of electricity during the peak period. $ per kWh

c. Find the quantity of electricity demanded during the peak period. million kWh

d. Find the price of electricity during the off-peak period $ per kWh

e. Find the quantity of electricity demanded during the off-peak period. million kWh

Now suppose instead a uniform price of **$ 0.12** per kilowatt-hour is used in both peak and off-peak periods.

f. Find the quantity of electricity demanded during the peak period. million kWh

g. Find the quantity of electricity demanded during the off-peak period. million kWh

h. Would generation capacity have to *increase, decrease*, or *stay the same* to accommodate uniform pricing?

i. By how much? million kWh

j. In the graph above, shade the areas representing deadweight loss from uniform pricing.

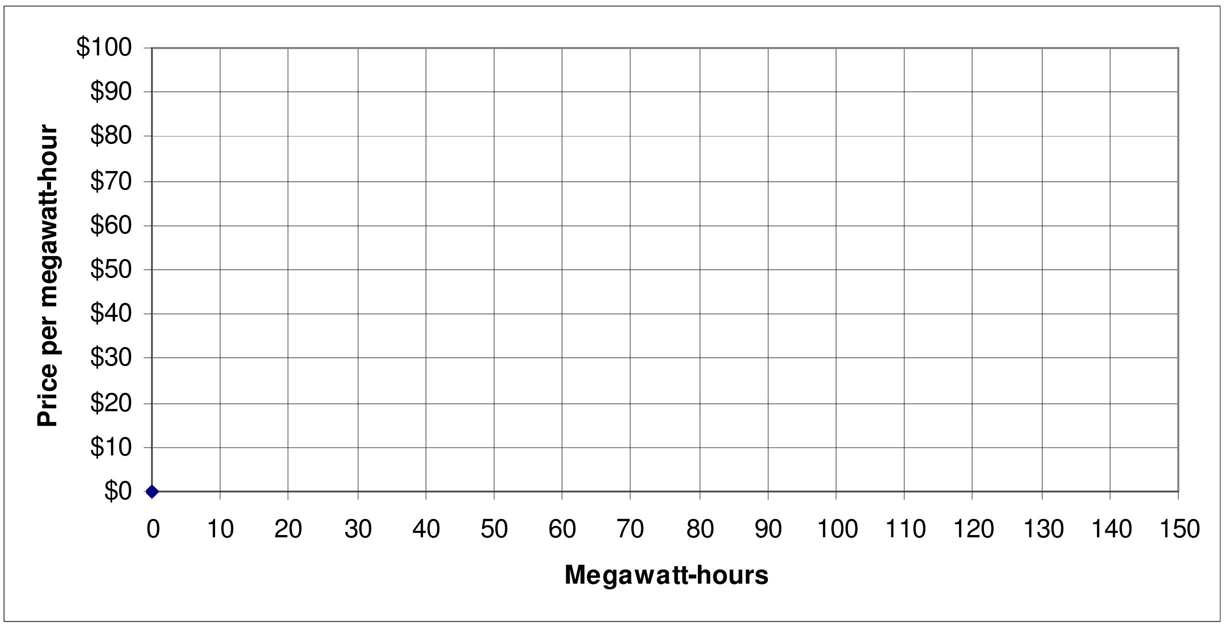
k. Compute the social deadweight loss from uniform pricing. $ million

(2) [Wholesale power markets, economic dispatch: 20 pts] Suppose you manage the Regional Transmission Organization (RTO) for a power grid and you have received the following four "asks" from power suppliers ("generators") for the hour ending 3 PM:

- Generator A: 10 megawatt-hours at $70 per megawatt-hour.
- Generator B: 50 megawatt-hours at $30 per megawatt-hour.
- Generator C: 40 megawatt-hours at $40 per megawatt-hour.
- Generator D: 20 megawatt-hours at $20 per megawatt-hour.

and the following three "bids" from power demanders ("loads") for the same hour:

- Load #1: 20 megawatt-hours at $80 per megawatt-hour.
- Load #2: 30 megawatt-hours at $70 per megawatt-hour.
- Load #3: 40 megawatt-hours at $90 per megawatt-hour.



a. [4 pts] Plot demand and supply curves for these asks and bids.
b. [8 pts] Given these asks and bids, what amount of power will you order each generator to supply?

Generator A	megawatt-hours
Generator B	megawatt-hours
Generator C	megawatt-hours
Generator D	megawatt-hours

c. [4 pts] What price for electric power will you set for this hour? | $ per megawatt-hour

d. [4 pts] Suppose an unexpected event (increased demand or failure of a generator) requires you to find another megawatt-hour of power. Which generator will you call on to deliver that extra power?

(3) [Sources of market power: 16 pts] According to the model of "dominant-firm price leadership," the dominant firm's residual elasticity of demand is given by the formula

$$|\varepsilon_{DF}| = \frac{|\varepsilon_M| + (1 - S_{DF})\beta_{CF}}{S_{DF}}$$

where ε_{DF} denotes the residual elasticity of demand faced by the dominant firm, ε_M denotes the total market elasticity of demand, S_{DF} denotes the market share of the dominant firm, and β_{CF} denotes the elasticity of supply of the "competitive fringe" of other suppliers.

Consider the application of this formula to the market for wholesale electric power, where the "dominant firm" is an individual wholesale power generator, and the "competitive fringe" consists of all other power generators in the same market.

First, suppose the market elasticity of demand = $|\varepsilon_M| = 0.25$, the individual power generator's market share = $S_{DF} = 0.1$, and the elasticity of supply of all other power generators = $\beta_{CF} = 0.3$.

a. Compute the absolute value of the individual power generator's elasticity of demand ($|\varepsilon_{DF}|$) to three significant digits.

b. Compute the individual power generator's price-cost margin (or Lerner index) to three significant digits.

Second, consider the effect of the following policy changes on market power.

Suppose more generators join the wholesale electricity market.

c. Which parameter in the formula (ε_M , S_{DF} , or β_{CF}) changes?

d. Does the absolute value of the individual power generator's elasticity of demand ($|\varepsilon_{DF}|$) *increase, decrease,* or remain *constant?*

e. Does the individual power generator's price-cost margin (or Lerner index) *increase, decrease,* or remain *constant?*

Suppose real-time pricing is imposed on *retail* electricity customers.

f. Which parameter in the formula (ε_M , S_{DF} , or β_{CF}) changes?

g. Does the absolute value of the individual power generator's elasticity of demand ($|\varepsilon_{DF}|$) *increase, decrease,* or remain *constant?*

h. Does the individual power generator's price-cost margin (or Lerner index) *increase, decrease,* or remain *constant?*

III. Critical thinking [3 pts]

In the electric power industry, some utilities are vertically integrated and some are not. Vertically-integrated utilities own power generation facilities as well as distribution networks to retail customers. Non-vertically-integrated utilities do not own power generation facilities.

Which type of firm is subject to more wholesale power price risk? Why?

Please write your answer below. Full credit requires correct economic reasoning, legible writing, good grammar including complete sentences, and accurate spelling.

[end of quiz]