NAME_____

CE156 Midterm
October 20, 2011

Answer all 5 questions. Closed book and closed note (no cheat sheet). Calculator is allowed (programmable is ok), but no smartphones (or any communication devise). There are a total of 100 points and the points are stated for each question.

Put all answers on this exam sheet, using the back if necessary. Full credit requires that you show your work and we are able to follow it.

GRADE BOX

Problem	Points Available	Your Score
1	12	
2a,b	8	
2c	8	
3a	6	
3b	6	
3c	6	
3d	6	
4a	12	
4b	6	
4c	6	
5a	4	
5b	4	
5c	8	
5d	2	

1) True/False – CIRCLE YOUR ANSWER. [12 points total; 2 for each question]

TRUE or **FALSE** The private sector is the primary funding source for drinking water infrastructure.

TRUE or FALSE Both the European Union and China are spending more on infrastructure (in terms of % of GDP) than the United States.

TRUE or **FALSE** In the United States, planning for infrastructure is mostly done at the Federal level.

TRUE or FALSE A demand function can be derived by solving the consumer choice problem of maximizing utility subject to an income constraint.

TRUE or FALSE The inductive approach of developing a production function requires knowledge of the engineering process.

TRUE or **FALSE** All points on a particular production function isoquant represent combination of inputs that cost the same.

2) HKS (16 points, 8 points for a and b, 8 points for c)
   a) Using the scale below, what is the order of magnitude of the expected costs of the California High Speed Rail (both phases)? **$50-55 billion, vii**
   b) What was the part of the Electric Vehicle infrastructure was progressing more slowly than planned? **Charging station installation.**

   Scale

   i) $10,000 (tens of thousands)
   ii) $100,000 (hundreds of thousands)
   iii) $1,000,000 (millions)
   iv) $10,000,000 (tens of millions)
   v) $100,000,000 (hundreds of millions)
   vi) $1,000,000,000 (billions)
   vii) $10,000,000,000 (tens of billions)
   viii) $100,000,000,000 (hundreds of billions)
   ix) $1,000,000,000,000 (trillions)

   c) Using the space below, answer **ONE** of the two following questions. If you enter an answer for both, be clear which one you want graded (or else we'll grade the first). Note that there is no correct answer for the opinion questions, but you need to justify your answer.
      i) What are the various sources of funding that are proposed to make up the funds necessary for CAHSR? Do you think the projected cost estimate of the HSR is about right, too high, or too low (explain your reasoning).
      ii) What are the components of the SF plan to develop electric vehicle infrastructure? Do you think this is about the right level of effort, too little, or too much (explain your reasoning).

Funding sources include state bonds, federal stimulus funds, and state funds. Also the projected excess train fares (beyond what's needed for operation and maintenance) will be used to leverage private investment. The project costs are probably too low, as estimates have steadily increased over the past few years. Large projects tend to have an underestimated budget because many costs go undiscovered through the design phase. Also the costs are low per mile relative to existing HSR. You could have had other answers, as long as they were well justified.

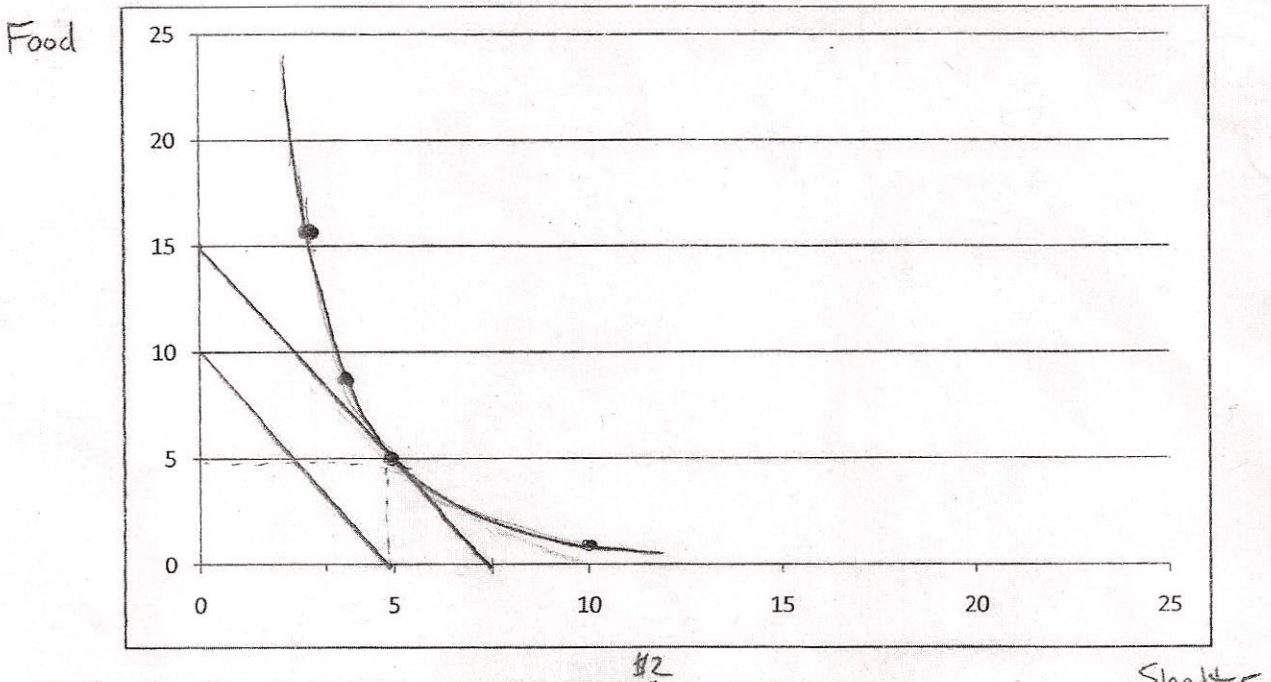
The components include providing tax breaks for household charging installation, the installation of public charging stations, and improved efficiency of the installation permitting process. The level of effort has been too low if San Francisco wants to become the Electric Vehicle Capital of the World. Only 70 of the 200 proposed charging points have been installed. You could have had other answers, as long as they were well justified.

3) Utility Theory (24 points, 6 points each)

The following table provides the inputs of food and shelter to provide an indvidual 50 utils.

Shelter	Food	Utility
5	5	50
10	1	50
3	16	50
4	8	50

a) Show the plot of Food vs. Shelter with Food on the Y axis.



b) The price of Food is $1 and the price of Shelter is $2, plot the budget lines.

c) What is the (approximated) minimum budget necessary to obtain 50 utils?

Min budget = $15. Can see from intersection of (15,0) or (0,7.5).

$15(P_x) + 0(P_y) = 15(1) = \boxed{\$15}$

d) What is the MRS at the optimal point? (state the numerical value as well as the interpretation in words.)

Optimality! $MRS = -\frac{MU_x}{MU_y} = -\frac{P_x}{P_y} = -\frac{2}{1} = \boxed{-2}$

This is the slope of the budget line and the slope of the utility isoquant at (5,5).

It represents the rate at which a consumer is ready to give up one good in exchange for another good, while maintaining the same utility.

In this case, the individual would give up 2 units of Food for 1 unit of Shelter.

4) Discrete Choice Analysis 1 (24 points)

Consider a mode choice model for UC Berkeley staff with the following specification:

$$U_{drive} = -0.04\ln(Time_{drive}) - 0.01Cost_{drive} + \beta\,(gender = female) + \varepsilon_{drive}$$
$$U_{transit} = -0.04\ln(Time_{transit}) - 0.01Cost_{transit} + \varepsilon_{transit}$$
$$U_{walk} = -0.04\ln(Time_{walk}) + \varepsilon_{walk}$$

where ε_{drive}, ε_{drive}, ε_{drive} are i.i.d. Extreme Value, Time is in minutes and Cost is in $.

a. Assuming β equals 0.1, Calculate the probability of driving for a woman who has the choice between a 15 minute car trip that costs $5, a 30 minute transit trip that costs $2, and a 40 minute walk that is free. (12 points)

$$P(drive) = \frac{\exp(-0.04\ln(15) - 0.01(5)) + 0.1)}{\exp(-0.04\ln(15) - 0.01(5) + 0.1) + \exp(-0.04\ln(30) - 0.01(2)) + \exp(-0.04\ln(40))}$$

$$= \frac{\exp(-0.058)}{\exp(-0.058) + \exp(-0.156) + \exp(-0.146)} = \boxed{0.354}$$

b. What is the value of time (as a function of trip time) implied by the model? What does this say about the sensitivity to time relative to the length of the trip? (6 points)

$$VOT = \frac{\frac{\partial U}{\partial T}}{\frac{\partial U}{\partial P}} = \frac{-0.04\,\frac{1}{Time}}{-0.01} = \boxed{\frac{4}{Time} = VOT\ [\$/min]}$$

The longer the trip, the less sensitive one is to time.

c. Now assume β is unknown. If you were to design a survey to calculate the value of the parameter, what information would you need to collect? (6 points)

n	male or female	choice	Drive Time	Drive Cost	Transit Time	Transit Cost	Walk Time

This survey should be taken from a sample of UC Berkeley Staff

5) Production and Optimization (24 points)

Assume a plant has a production function:

$$Q = L^{0.8}K^{0.2}$$

The cost of each unit of labor (L) is \$10 and capital (K) is \$20. The plant's budget is \$500.

a) Formulate the optimization problem for the maximization of production. (4 points)

Maximize: $L^{0.8}K^{0.2}$

Subject to: $10L + 20K = 500$

b) Write the Lagrangean equation and list the unknowns. (4 points)

$$\mathcal{L} = L^{0.8}K^{0.2} - \lambda(10L + 20K - 500)$$

unknowns:
L = Labor
K = Capital
λ = Lagrange Multipliers.

c) Write the equations needed to solve for the unknowns, but do not solve the system. (8 points)

$$\frac{\partial \mathcal{L}}{\partial L} = 0.8L^{-0.2}K^{0.2} - \lambda(10) = 0$$

$$\frac{\partial \mathcal{L}}{\partial K} = 0.2L^{0.8}K^{-0.8} - \lambda(20) = 0$$

$$\frac{\partial \mathcal{L}}{\partial \lambda} = 10L + 20K - 500 = 0$$

d) Assume the value of the Lagrange multiplier is 5. What does this mean? (2 points)

This means that a unit increase in budget (i.e. \$1) would cause a production increase of 5 units.