final exam.

Part A. *True/False/Uncertain. For each, state whether the statement is true/false/uncertain and justify your answer.*

1) A consumer has monotonic and convex preferences over bundles of two goods and is maximizing utility. If she is already consuming some of both goods, then *a marginal increase in expenditure on either good will lead her utility to increase at the same rate*.

2) A consumer has convex and homothetic preferences over bundles of two goods. For her, *neither good can be inferior*.

3) A firm uses two inputs x_1 and x_2 to produce output and minimizes costs. At input prices $w_1 = 3$ and $w_2 = 1$ and at input prices $w_1 = 1$ and $w_2 = 3$ it costs \$200 to produce 10 units of output. *The firm's costs of producing* 10 *units when the input prices are* $w_1 = 2$ *and* $w_2 = 2$ *will never be strictly less than* \$200.

Part B. *Answer These.*

harmonicas.

A firm produces harmonicas h using labor (x_1) *and robots* (x_2)*. The cost of labor is* w_1 *and the cost of robots is* w_2*. The production function is* $h = \frac{1}{\frac{1}{x_1}+\frac{1}{x_2}}$.

A) Does the firm have increasing, decreasing or constant returns to scale?

B) Does the firm have increasing, decreasing or constant marginal product for each input?

C) Given *only your answer to part A*, can the firm's cost function be strictly convex in h? How do you know?

D) Say something about how a firm with the production function above uses inputs compared to how a firm with production function $h = x_1^{\frac{1}{2}} x_2^{\frac{1}{2}}$ uses inputs.

E) What are the conditional factor demands for labor and robots when production function is $h = \frac{1}{\frac{1}{x_1}+\frac{1}{x_2}}$?

F) What is the cost function for the firm?

G) Confirm Shephard's lemma holds.

Let $w_1 = 1$ *and* $w_2 = 4$*. Demand for harmonicas is given by* $h = 81 - p$.

H) If the firm acts as a monopolist, how many harmonicas would it sell?

I) How many harmonicas would be sold by *two firms* with the production function $h_i = \frac{1}{\frac{1}{x_1}+\frac{1}{x_2}}$ competing in Cournot oligopoly?

J) If the firms collude, the will be caught by the government and have to pay a total fine of Z dollars (each firm pays $\frac{Z}{2}$). What is the smallest Z that will prevent the firms from colluding?

K) Is there a Z such that the firms would choose to collude and consumers would be better off under collusion (receiving the transfer of Z) than if the firms chose not to collude (not receiving the transfer of Z)?

[(work)(rap)(nap)].

G. is preparing for a presentation on nested parentheses. He has t hours until the presentation. He can work on slides (s), listen to "boasty" Kanye West music (r), or nap (n).

G's goal is to maximize the quality of his presentation, which is measured in applause time (a). If he ***remembers to sleep*** *the night before, the quality of his presentation is given by $a = [(s)\,(r+1)]^{\frac{1}{3}}$ where a is the seconds of applause he will receive. Note, in this instance, napping will not benefit his presentation and so n does not appear.*

A) Characterize how $G.$ should spend his time given any amount of time t.

B) Write down the amount of applause $G.$ can achieve given t hours of time.

C) What is G's elasticity of applause (a) with respect to time available (t)?

When G. ***forgets to sleep****, his presentation will benefit from a nap. In this instance, the quality of his presentation is given by $a = [(s)\,(r+1)\,(n)]^{\frac{1}{3}}$.*

D) Characterize how $G.$ should spend his time given any amount of time t.

E) Write down the amount of applause $G.$ can achieve given t hours of time.

On Mondays, G. is incapable of napping for more than an hour. If he tries to nap for longer, he will just lay there, staring at the ceiling. Thus, ***on Mondays when he forgets to sleep,*** *the quality of his presentation is $a = [(s)\,(r+1)\,(Min\,\{n,1\})]^{\frac{1}{3}}$.*

F) Characterize how $G.$ should spend his time given any amount of time t.

G) Write down the amount of applause $G.$ can achieve given t hours of time.

H) Using your answers above, say something interesting comparing G's decisions under each condition (*slept*, *did not sleep*, *did not sleep and it is Monday*). Is he ever better off having not slept?