

Econ 525 Practice Midterm Questions

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Instructions. Answer all **SIX** questions. You may refer to all definitions and results given in the lectures. Please clearly state each step of your argument. If you cannot completely solve a problem, you can still obtain partial credits by demonstrating how you would approach it or by making simplifying assumptions that do not turn the problem trivial.

- (15 points) A consumer's preferences over consumption bundles in \mathbb{R}_+^2 are defined as follows:
 $(x_1, x_2) \succ (y_1, y_2)$ if and only if $x_1 > y_1$ and $x_2 > y_2$.
Check if the relation " \succ " satisfies the three axioms of order relations. Is it an order relation?
- (15 points) Consider a sequence $\{x_n\} \subset \mathbb{R}$. Let $m = \limsup_{n \rightarrow \infty} x_n$ and $M > m$. Show that there exists N , such that $x_n < M$ for all $n > N$.
- (20 points) Consider an arbitrary metric space (X, d) . Prove the following two statements:
 - Let $\{K_i\}_{i=1}^n$ be a finite collection of compact sets in X . Then, $\cup_{i=1}^n K_i$ is compact.
 - Let $\{K_\alpha\}$ be an arbitrary collection of compact sets in X . Then, $\cap_\alpha K_\alpha$ is compact.
- (20 points) Check if set A is open, closed, or compact in the metric space (X, d) .
 - $A = \mathbb{Q}_+$, $X = \mathbb{Q}$, and $d(x, y) = |x - y|$.
 - $A = \{0\} \cup \{(-1)^n \frac{1}{2^n}, n \in \mathbb{Z}_+\}$, $X = \mathbb{R}$, and $d(x, y) = |x - y|$.
- (10 points) Check if the function $f : \mathbb{Z} \rightarrow \mathbb{R}$ is continuous.

$$f(x) = \begin{cases} 0, & x \leq 0; \\ 1, & x > 0. \end{cases}$$

6. (20 points) True or False. Examine if each of the following statements is true or false, and show your reasoning.
- a. Finite sets are closed.
 - b. Consider two convergent sequences in \mathbb{R} : $\{a_n\} \rightarrow a$ and $\{b_n\} \rightarrow b$. If $a_n > b_n$ for each n , then $a > b$ must hold.