IM 7011: Information Economics, Spring 2018 (106-2)
Quiz

Instructor: Ling-Chieh Kung
Department of Information Management
National Taiwan University

Name: _____ Student ID: _____

Note. This quiz count for 5% of your final grades for this semester. If you cannot finish this quiz in 30 minutes (with the help of textbooks and Internet), you need to work extremely hard in this course. Submit this quiz paper in class by ***9:30 am, March 9, 2018***. You may also submit it into the instructor's mailbox on the first floor of Management Building 2 by ***9:10 am, March 9, 2018***.

1. (a) Let $f(x) = 4x^4 + 2x^3 - x^2 + 3$. Find $\frac{d}{dx} f(x)|_{x=1}$.

   (b) Let $f(x) = 4x_1^4 + 2x_1x_2^2 - x_2^2 + 3$. Find the gradient $\nabla f(x)$ and Hessian $\nabla^2 f(x)$.

   (c) Let $f(x) = \ln(x^2 + 2)e^{2x}$. Find $\frac{d}{dx} f(x)$.

2. (a) Let $f(x) = 2x^2 + 3x + 5$. Find $\int_0^2 f(x)dx$.

   (b) Let $f(x) = x_1x_2^2 + e^{2x_1}$. Find $\int f(x)dx_1$ (you may ignore the constant).

   (c) Find $\frac{d}{dx} \int_0^x (t^3 + 3t - 2)dt$.

3. Answer the following questions.

   (a) What are the expected value and variance of rolling a fair dice?

   (b) Let $f(x) = kx^2$ be the probability density of a continuous random variable $X \in [0, 1]$. Find the value of k. Then find $\mathbb{E}[X]$.

4. Consider the following linear program

$$\begin{array}{rlrcrcrl} z^* = & \min & 3x_1 & + & x_2 & & & \\ & \text{s.t.} & x_1 & + & 2x_2 & \geq & 6 & (1) \\ & & x_1 & + & x_2 & \geq & 3 & (2) \\ & & x_1 & & & \geq & 0. & (3) \end{array}$$

(a) Draw the feasible region.

(b) Find an optimal solution.

(c) Is there any constraint binding at your optimal solution? If so, find them.

(d) Is there any redundant constraint? If so, find them.

5. Consider $f(x) = x^3 + 2x^2$ and $g(x) = x^3 - 2x^2$.

(a) Is f a convex function over $[0, \infty)$?

(b) Over what region is g a convex function?

6. Consider the following payoff matrix for a two-player static game

	D	E	F	G
A	$3,2$	$2,3$	$5,3$	$3,4$
B	$1,6$	$3,6$	$2,4$	$1,3$
C	$3,3$	$4,0$	$5,2$	$3,2$

(a) Find all the Nash equilibria, if any.

(b) Is there any strictly dominated strategy? If so, find them.