

INTERNATIONAL UNIVERSITY OF JAPAN  
Public Management and Policy Analysis Program  
Graduate School of International Relations

DCC5350 (2 Credits)  
**Public Policy Modeling**  
Spring 2016

**Homework 1: Basic Math (100 points)**

**Instruction:** PLEASE *handwrite*; DO NOT use a wordprocessor. Write down your student ID and name on the top of your answer. Organize your answer in the ascending order (1, 2, ...) and use single column. Show all necessary steps to get the answer; DO NOT simply write down an answer. You MAY NOT communicate with others except for the TAs and instructor to do this homework. Submit your answer to TAs at the start of the class on April 13<sup>th</sup>.

■ **Question 1 (10 points):** simplify following expressions. Follow ALL necessary steps.

Q 1.1 (5 points)  $-\frac{2}{3} + 2 - \frac{7}{5} =$

Q 1.2. (5 points)  $-(-3) \times \left(\frac{2}{5}\right)^{-1} - 7 =$

■ **Question 2 (15 points):** Solve following equations for  $x$  and/or  $y$ . Show ALL necessary steps.

Q 2.1 (5 points)  $\frac{3}{2} - \frac{2x^2}{4x} = 2x$

Q 2.2 (10 points)  $\begin{cases} 3x - 5y = -4 \\ 5x = 2 - 7y \end{cases}$

■ **Question 3 (10 points):** Newton's second law of motion says that the force ( $F$ ) on an object is equal to the mass ( $m$ ) of that object multiplied by the acceleration ( $a$ ) of that object. And an instantaneous acceleration ( $a$ ) at a point in time is derivative of velocity ( $dv$ ) with respect to derivative time ( $dt$ ). The formulas are,

$$F = ma \text{ and } a = \frac{dv}{dt}. \text{ Thus } F = m \frac{dv}{dt}$$

Q 3.1 (5 points) Rearrange the last formula with respect to mass ( $m$ ).

Q 3.2 (5 points) Rearrange the last formula with respect to derivative of velocity ( $dv$ ).

■ **Question 4 (10 points):** Indicate relevant region of  $4x - 2y \leq 6$ . Show how you draw the linear equation line and how you select a region.

■ **Question 5 (35 points):** Answer the following questions using matrices A through C below. Show all necessary steps for Q5.1 through Q5.5; otherwise, you may not get full credits.

► Use  $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$  and  $B = \begin{bmatrix} 5 & 6 \\ 7 & 8 \end{bmatrix}$

**Q 5.1 (2 points)** Get  $A+B$ ,  $A-B$ .

**Q 5.2 (10 points)** Get  $AB$  and  $BA$ .

**Q 5.3 (3 points)** Get  $A'$  and  $B'$  (transpose).

**Q 5.4 (2 points)** Get  $|A|$  and  $|B|$ .

**Q 5.5 (3 points)** Get  $A^{-1}$  and  $B^{-1}$ .

► Use  $C = \begin{bmatrix} .1 & .2 & .3 & .4 \\ .4 & .3 & .2 & .1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$

**Q 5.6 (3 points)** Get  $C'$  manually.

**Q 5.7 (4 points)** Get  $CC$  using Excel.

**Q 5.8 (4 points)** Get  $|C|$  using Excel.

**Q 5.9 (4 points)** Get  $C^{-1}$  using Excel.

\*Make an Excel worksheet for Q5.7-Q5.9 with your ID and name on the 1<sup>st</sup> row. Attach a hardcopy of the worksheet as your answer (Do not solve Q 5.7-Q5.9 manually).

**■ Question 6 (20 points):** The following cross-tab shows whether three ethnic groups voted in the November 2006 election. The source of data is Pew Internet and American Life Project's November 2006 Post-Election Tracking Survey (<http://www.pewinternet.org/>). A total of 5,339 respondents answered to this question. The first column reads "2,735 white constituents voted and 1,403 did not in the 2006 election.

	White	Black	Hispanic
Voted	2,735	(?)	233
Did not vote	1,403	257	345

**Q 6.1 (2 points)** Calculate the probability that a randomly chosen respondent is a black constituent. You need to fill the blank in the cross-table above first to get such a marginal probability,  $P(\text{Black})$ .

**Q 6.2 (5 points)** Calculate the conditional probability that each ethnic group has voted (column percentage):  $P(\text{Voted}|\text{White})$ ,  $P(\text{Voted}|\text{Black})$ , and  $P(\text{Voted}|\text{Hispanic})$

**Q 6.3 (3 points)** What is the probability that a randomly chosen constituent is a black voter? This is a joint probability.

**Q 6.4 (5 points)** What is the probability that a randomly chosen voter is a black constituent? That is,  $P(\text{Black}|\text{Voted})$

**Q 6.5 (5 points)** Based on the results of Q6.1 and Q6.4, would you conclude that ethnic group is statistically independent of voting? Show me your reasoning.

End of homework 1.