

1. (6 points) Products P and Q are made from raw materials R and S. One ton of P uses 2 tons of R and 4 tons of S. One ton of Q uses 2 tons of R and 3 tons of S. The total amount of R available is 17 tons and the total amount of S available is 12 tons. The profit per ton of P is \$140 and the profit per ton of Q is \$150.

(a) Introduce variables to set this up as a linear programming problem.

**x = amount of product P produced,**  
**y = amount of product Q produced.**

(b) Write down a mixture chart for this problem.

	R	S	profit
P	2	4	140
Q	2	3	150
	17	12	

(c) Write down **all** the constraint inequalities.

$$2x + 2y \leq 17, \quad 4x + 3y \leq 12, \quad x \geq 0, \quad y \geq 0.$$

(d) Write down an expression for the profit.  $140x + 150y.$

[You do **not** need to solve this problem any further]

2. (7 points) Maximize the function  $x - y$  subject to the constraints  $x \geq 0, y \geq 0, x + 2y \leq 12, 2x + y \leq 12, x + y \geq 7$  (**note**  $\geq$ ).

(a) Sketch the feasible region on the graph shown: **See picture.**

(b) Find the corners of the feasible set.

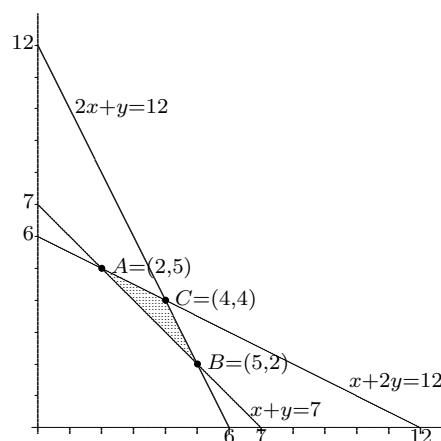
	A	B	C
Line 1	$x + 2y = 12$	$2x + y = 12$	$2x + y = 12$
Line 2	$x + y = 7$	$x + y = 7$	$x + 2y = 12$
Subtract	$y = 5$	$x = 5$	$x - y = 0$
$\Rightarrow$	$x = 2$	$y = 2$	$x = y = 4$

**Points: A = (2, 5), B = (5, 2), C = (4, 4).**

(c) Where is the function maximized?

Point	$x - y$
A (2, 5)	-3
<b>B (5, 2)</b>	<b>3</b>
C (4, 4)	0

**Function maximized at  $x = 5, y = 2.$**



3. (3 points) It is desired to select 4 members of a health club with 600 members to ask them about their experiences. Explain how to achieve this using the following table of random numbers.

102|890|215|699|102|174|921|165|830|247|172|577|654|1

**Assign numbers 001, 002, ..., 600 to the members of the club.**

**Choose members 102, 215, 174, 165.**

4. (3 points) Which of the following statements are true of a table of random digits and which are false?

(a) There are exactly four 0's in each row of 40 digits.

True / **False**

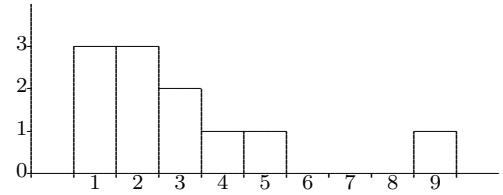
(b) Each pair of digits has chance 1/100 of being 00.

**True** / False

(c) The digits 00000 can never appear as a group because this pattern is not random.

True / **False**

5. (9 points) The number of defects in some batches of sheet glass are: 1, 5, 1, 3, 2, 9, 4, 1, 2, 3, 2



- a) Draw a histogram representing this information. (Use classes of size 1.)  
 b) Describe the distribution fully.  
**Not symmetric, skewed to right, one outlier.**

- c) Calculate the mean and median.  
 $\text{Mean} = \frac{1+5+1+3+2+9+4+1+2+3+2}{11} = \frac{33}{11} = 3.$   
**1 1 1 2 2 2 3 3 4 5 9 : Median = 2.**

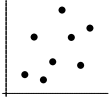
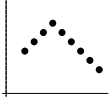

- d) Which is larger, mean or median? Why could you guess this from the histogram?  
**Mean, since distribution is skewed to right.**

- e) Calculate the 5 number summary.  
**[1 1 1 2 2] 2 [3 3 4 5 9] : Summary = 1, 1, 2, 4, 9.**

6. (6 points)

- (a) Explain carefully what is meant by confounding variables.  
**Several variables which influence the outcome so that one cannot distinguish the effect of each one individually.**
- (b) How would one reduce the effects of confounding?  
**Use a randomized comparative experiment with a control group.**
- (c) Explain carefully what is meant by margin of error in a survey.  
**95% of similar surveys should get within the margin of error of the true population value.**
- (d) How would one reduce the margin of error?  
**Increase the number of people surveyed.**

7. (6 points) For each of the three scatterplots below, circle the most likely correlation coefficient ( $r$ ), and whether or not you think  $x$  and  $y$  are strongly related.

- (A)  1)  $r = -.9$  2)  $r = -.3$  3)  **$r = .3$**  4)  $r = .9$   
 Strongly related Yes / **No**
- (B)  1)  $r = -.9$  2)  **$r = -.3$**  3)  $r = .3$  4)  $r = .9$   
 Strongly related **Yes** / No
- (C)  1)  $r = -.9$  2)  $r = -.3$  3)  $r = .3$  4)  **$r = .9$**   
 Strongly related **Yes** / No

Grading Scale: A: 35–40, B: 29–34, C: 23–28, D: 19–22, F: 0–18.