#1

x = the number of dozen cake donuts
y = the number of dozen of glazed donuts
z = the number of dozen of jelly donuts

$$\begin{array}{lcl} \text{eggs} & 2x + y + 3z &= 100 \\ \text{flour} & 2x + 2y + 3z &= 130 \\ \text{sugar} & x + y + 2z &= 70 \end{array}$$

#2

$$\begin{array}{l} \\ R_2 - 2R_1 \\ R_3 + 3R_1 \end{array} \begin{bmatrix} ① & 2 & -3 & 5 \\ 2 & 3 & -4 & 7 \\ -3 & -4 & 5 & -9 \end{bmatrix} \quad \begin{array}{l} R_1 + 2R_2 \\ \\ R_3 + 2R_2 \end{array} \begin{bmatrix} 1 & 2 & -3 & 5 \\ 0 & ⊖1 & 2 & -3 \\ 0 & 2 & -4 & 6 \end{bmatrix}$$

$$\begin{array}{l} \\ -1 * R_2 \\ \\ \end{array} \begin{bmatrix} 1 & 0 & 1 & -1 \\ 0 & -1 & 2 & -3 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} ① & 0 & 1 & -1 \\ 0 & ① & -2 & 3 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

$$\begin{array}{rcl} x \quad + z &=& -1 \\ y - 2z &=& 3 \end{array}$$

infinitely many solutions

$$x = 1 - z$$
$$y = 3 + 2z$$

#3a

$$x \quad + z = -1$$
$$y - 2z = 3$$
$$0 = 4$$

#3b No solution ↑

#4

$$x + 2y + s = 80$$
$$-x + 3y + t = 60$$
$$x + u = 50$$
$$-3x + y + p = 0$$

	x	y	s	t	u	p	
s	1	2	1	0	0	0	80
t	-1	3	0	1	0	0	60
u	1	0	0	0	1	0	50
	-3	1	0	0	0	1	0

4. Write the initial tableau for the following linear programing problem. You need not solve the problem.

Maximize $p = 3x - y$.

subject to the following constraints.

$$
\begin{array}{rrcl}
x & +2y & \le & 80 \\
-x & +3y & \le & 60 \\
x & & \le & 50 \\
x & & \ge & 0 \\
 & y & \ge & 0
\end{array}
$$

5. The following is an initial tableau. Determine the pivot.

	x	y	z	s	t	u	p	
s	1	2	2	1	0	0	0	30
t	3	0	1	0	1	0	0	36
u	0	2	1	0	0	1	0	14
	−4	−8	−6	0	0	0	1	0

test quotients

$30/2 = 15$

$36/0$ not defined

$14/2 = 7$ ←

Phase II

6. The following is an initial tableau. Determine the pivot.

	x	y	z	s	t	u	p	
* s	4	1	−1	−1	0	0	0	6
* t	3	1	0	0	−1	0	0	5
* u	2	1	0	0	0	−1	0	4
	36	12	−7	0	0	0	1	0

test quotients
6/4 ←
5/3
4/2 = 2

Phase I

7. The following is a final tableau. Determine the maximum value of p and the values of x, y, and z.

	x	y	z	s	t	u	p	
y	0	6	0	1	−1	3	0	1200
x	4	0	0	1	1	−3	0	400
z	0	0	6	−1	1	3	0	900
	0	0	0	5	1	9	12	7800

$p = 7800/12 = 650$
$x = 400/4 = 100$
$y = 1200/6 = 200$
$z = 900/6 = 150$

#8a

Maximize $p = 30x + 40y$

subject to

$$
\begin{aligned}
100x + 150y &\le 600000 \\
x + y &\le 2500 \\
x &\ge 0 \\
y &\ge 0
\end{aligned}
$$

#8b

	x	y	s	t	p	
s	100	150	1	0	0	600000
t	1	(1)	0	1	0	2500 ←
	−30	−40	0	0	1	0

↑ (under the y column)

#8c

*8a. Formulate the following linear programming problem; i.e., write the objective function and structural constraints. Let p equal the amount of profit, x equal the number of machine A, and y equal the number of machine B produced. You need not solve the problem.

> National Business Machines Corporation manufactures two models of fax machines: A and B. Each model A costs $100 to make, and each model B costs $150. The profits are $30 for each model A and $40 for each model B fax machine. If the total number of fax machines demanded each month does not exceed 2500 and the company has earmarked no more than $600,000 per month for manufacturing costs, find how many units of each model the company should make each month to maximize its monthly profits.

*8b. Write the initial tableau.

*8c. Determine the initial pivot. You need not do the pivot operation.

9. The following is neither an initial nor a final tableau.

	x	y	z	s	t	u	p		test quotient
s	(2)	0	12	4	0	−1	0	2000	2000/2 ←
t	0	0	−8	0	1	−2	0	2000	2000/0
y	2	4	8	0	0	1	0	4000	4000/2
	−2	0	13	0	0	2	1	8000	
	↑								

9a. Determine the values of x, y, z, s, t, u, and p at this stage.

x=0, y=4000/4, z=0, s=2000/4, t=2000/1, u=0, p=8000/1

9b. Is the tableau in phase I or phase II? Phase II

9c. Determine the next pivot. You need not do the pivot operation.

#10

$$\begin{bmatrix} 2 & -4 & 1 \\ -3 & 6 & 5 \\ 1 & -3 & 7 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 6 \\ -1 \\ 0 \end{bmatrix}$$

#11

A | I

$$\left[\begin{array}{cccc|cccc} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ -1 & 1 & 0 & 1 & 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 1 & 0 & 0 & 1 & 0 \\ 0 & -1 & 0 & 1 & 0 & 0 & 0 & 1 \end{array}\right]$$

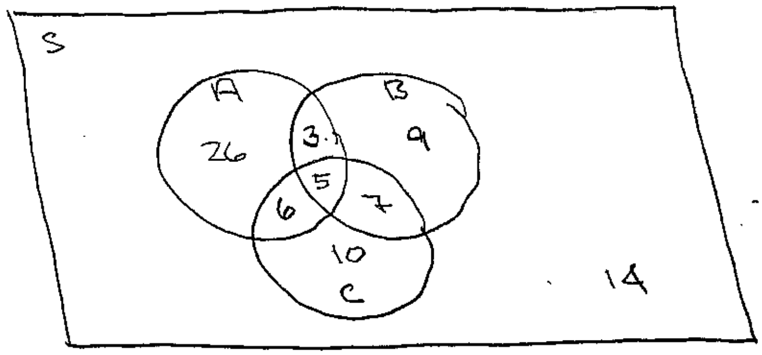
$$\left[\begin{array}{cccc|cccc} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & -1 & 0 & 1 & 0 & 0 & 0 & 1 \end{array}\right]$$

$$\left[\begin{array}{cccc|cccc} 1 & 0 & 1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & 1 & 1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 1 & 2 & 1 & 1 & 0 & 1 \end{array}\right] \quad \left[\begin{array}{cccc|cccc} 1 & 0 & 0 & -1 & 0 & 0 & -1 & 0 \\ 0 & 1 & 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 0 & 1 & -1 & 1 \end{array}\right]$$

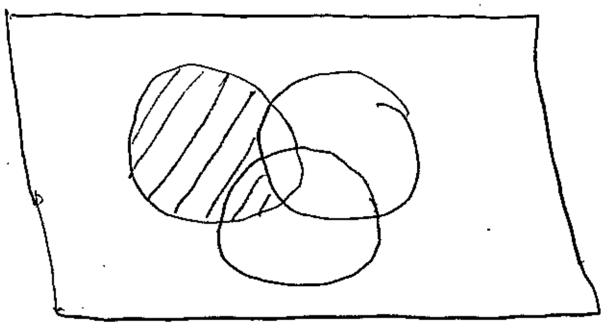
$$\left[\begin{array}{cccc|cccc} 1 & 0 & 0 & 1 & 0 & 1 & -2 & 1 \\ 0 & 1 & 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & 0 & 1 & -1 & 2 & -1 \\ 0 & 0 & 0 & 1 & 0 & 1 & -1 & 1 \end{array}\right]$$

I | A^{-1}

#12



$A \cap B'$



$m(A \cap B') = 26 + 6 = 32$

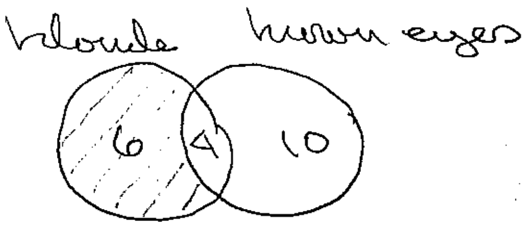
#13 $C(6,3) = 20$

#14 $P(6,3) = 120$

#15

$$C(6,3)\cdot C(10,4)$$
$$= 4200$$

#16



$$6/35 \approx 0.1714$$

#17

$$P(S \cup F) = P(S) + P(F) - P(S \cap F)$$
$$= 0.02 + 0.03 - 0.01$$
$$= 0.04$$

$$P(\text{no defects}) = 1 - P(S \cup F)$$
$$= 1 - 0.04$$
$$= 0.96$$

#18

$$P(\text{journalism} \mid \text{junior})$$

$$= \frac{P(\text{journalism} \cap \text{junior})}{P(\text{junior})}$$

$$= \frac{5/32}{12/32} = 5/12 \approx 0.4167$$

#19

$$P(A) = 15/100 = 3/20$$

$$P(550) = 20/100 = 1/5$$

$$P(A \cap 550) = \frac{10}{100} = 1/10$$

$$3/20 * 1/5 = P(A)P(550) \stackrel{?}{=} P(A \cap 550) = 1/10$$

No. Not independent

#20

$P(P) = 0.55$

$P(C) = 0.45$

$P(d|P) = 0.40$

$P(d|C) = 0.30$

$$P(C|d) = \frac{P(d|C)P(C)}{P(d|C)P(C) + P(d|P)P(P)}$$

$$= \frac{0.30 * 0.45}{0.30 * 0.45 + 0.40 * 0.55}$$

$$\approx 0.3802$$