

1. (15%) Seven young men order one of the followings at a restaurant: a cheeseburger(C), a hot dog(H), a taco(T), or a fish sandwich(F). How many different purchases are possible? Give a detailed description of how you solve this problem.
2. (15%) Simplify $\neg(p \wedge s) \rightarrow (\neg s \wedge p)$ using the laws of logic.
3. (10%) If $A = \{1, 2, 3, 4\}$, and $B = \{7, 8, 9\}$ determine the following:
 - (a) The number of relations from A to B that contain (2, 7) and (3, 9)
 - (b) The number of relations from A to B that contain exactly 6 ordered pairs
4. (10%) Let $S = \{3, 7, 11, \dots, 103\}$. How many elements must we select from S to insure that there will be at least two elements whose sum is 110? State your reasoning.

5. (10%) Find a PLU factorization of

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 0 & -1 & -1 & 4 \\ -2 & 3 & 2 & 1 \\ -6 & 4 & 2 & -8 \end{bmatrix}$$

6. (10%) To calculate $\begin{bmatrix} -3 & 1 \\ 2 & -2 \end{bmatrix}^{50}$

7. (10%) Find the best solution in the sense of least squares to the following linear system equations.

$$x+y=2$$

$$x-y=0$$

$$2x+y=-4$$

8. (10%) Find a QR factorization of

$$\begin{bmatrix} 2 & 1 \\ 1 & 1 \\ -2 & 0 \end{bmatrix}$$

9. (10%) Calculate the e^{At} , if $A = \begin{bmatrix} -3 & 0 \\ 1 & -3 \end{bmatrix}$