

NOTE- THE HW IS TWO PAGES LONG

1. (10 points) What is your name? Write it clearly. Staple your HW.
2. (10 points) Let $\vec{p} = \{0.5, 0.2, 0.2, 0.1\}$ (we denote the i th element of $\vec{p}$ by p_i) and $\vec{q} = \{0.2, 0.2, 0.1, 0.5\}$ (we denote the i th element of $\vec{q}$ by q_i).
 - (a) Compute $p_1 * p_1 + p_2 * p_2 + p_3 * p_3 + p_4 * p_4$.
 - (b) Compute $p_1 * q_1 + p_2 * q_2 + p_3 * q_3 + p_4 * q_4$.
 - (c) What point was I trying to make by having you do this?
3. (20 points) Assume that Alice and Bob are using a keyword mixed cipher. Assume the keyword is *funkytown*. Make the table to both encode and decode. (NOTE- THIS IS TWO TABLES- ONE TO ENCODE, ONE TO DECODE. ALSO NOTE- THE TABLE TO DECODE SHOULD TELL YOU HOW TO DECODE A, B, C, ETC, IN THAT ORDER, SO ITS USABLE BY ALICE AND BOB.) If Alice wants to send the message: *Computer Science and Math are a good double major*. What does she send?
4. (10 points) Write $(1234)_{10}$ (that is 1234 in base 10, normal numbers you are used to) as a base 2 number. Show all work.
5. (10 points) Write the following base 2 numbers in base 10: 1,11,111,1111,11111.
(Optional: Do you spot a pattern? what do you think $11 \cdots 1$ (n 1's) will be?)
6. (20 points) Alice and Bob are using the Vigenere Cipher with alphabet $\{a, b, c, \dots, z, 0, 1, \dots, 9\}$. The key is CS198 Alice wants to send Bob the message
I wish I had 101 Dalmations
What does Alice send?

7. (20 points) Alice and Bob are using the Matrix Cipher. The matrix is

$$\mathbf{A} = \begin{pmatrix} 1 & 2 \\ 7 & 5 \end{pmatrix}$$

Alice wants to send Bob the message

Young Scholars are jawesome!

What does Alice send?

8. (For your own benefit) Look up on the web how to find the inverse of a matrix in the normal numbers. Ponder how that might change mod 26.