Problem 1

a.) Question 2.1 In Reference Material.pdf (Dasgupta-Papadimitriou-Vazirani)
b.) multiply 5689 by 7892 using the integer multiplication algorithm with base=10

Problem 2

A.) State the pseudo-code of the Z-algorithm
B.) Use the Z-algorithm to compute Z values for the string.
S=xbxbxbbxbxbxbcxb

C.) if $Z_4 = 3$ and S[1..3]="abc" what is the value S[5]?

D.) if Z_{20}=6 and $Z_4 = 2$ then Z_{23}= ?

E.) if Z_{20}=6 and $Z_4 = 4$ then Z_{23}= ?

F.) if Z_{20}=6 and $Z_4 = 3$ then Z_{23}= ? this may not be a simple answer

G.) if Z_{20}=6 and $Z_4 = 3$ then S[20]=a' what character is at pos 4: S[4]?

Problem 3

Define $Q_i(S)$ as the length of the longest substring that starts at position i and matches a suffix of S starting at some position not equal to i. For example, in the string S= $rzbaaaxpdqbaaax$, $Q_3 = 5$. Show how to compute all the Q values (that is for all the i) in $O(|S|)$ time. This is not as obvious as it looks. It is not true that you just reverse S and compute the Z-values. But if you try that idea and see why it fails, you will probably next see the right idea.

Problem 4

Suppose you have a string matching algorithm that can take in (linear) strings S and T and determine if S is a substring (contiguous) of T. However, you want to use it in the situation where S is a linear string but T is a circular string, so it has no beginning or ending position. You could break T at each character and solve the linear matching problem $|T|$ times, but that would be very inefficient. Show how to solve the problem by only one use of the string matching algorithm. This has a very simple, cute, solution when you see it.