Computer Science & Engineering Department
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Computational Number Theory: CS60094
Assignment - 1 (Marks: 10)

<u>*Return on or before*</u>: *13^{th} February, 2015*

Write a *Python* function to implement the *Fast Fourier Transform* algorithm to compute DFT of a *signal* $a = (a_{n-1}, \cdots, a_0)$, where a_i's are complex numbers. The FFT function should take two parameters. The first parameter is the signal a and the second parameter is 1 for the computation of DFT, or -1 for the computation of DFT^{-1}.

Write a `main()` function that reads two positive integers a and b of some base (base has little role). The function `main()` invokes the FFT function to compute the product $a \times b$.

Input a and b are given as a sequence of *decimal-coded digits* in some base, separated by blank space. An input `12 34 56` in base 100 is treated as $12 \times 100^2 + 34 \times 100 + 56$. The same digit stream in base 64 is treated as $12 \times 64^2 + 34 \times 64 + 56$. Similarly an input `1 2 3` is treated as $1 \times 10^2 + 2 \times 10 + 3$ in decimal base, but treated as $1 \times 100^2 + 2 \times 100 + 3$ in base 100.
The product of a and b, the output, is again a digit stream from the most significant side.

The name of the python program file should be *roll number*`.py`. You may also prepare a README file if you want to communicate some information. If there are more than one files, prepare a `.tar` archive and send by e-mail to `goutamamartya@gmail.com`

1. Input: 1 2 3 4
   5 6 7 8
   Output: 5 16 34 60 61 52 32
   If we assume the base to be 10, then the first input is interpreted as 1234 and the second input is 5678 in decimal. Their product is 7006652. From the output we get, $5 \times 10^6 + 16 \times 10^5 + 34 \times 10^4 + 60 \times 10^3 + 61 \times 10^2 + 52 \times 10 + 32 = 7006652$.

   If we assume the base to be 16, then the first input is $1 \times 16^3 + 2 \times 16^2 + 3 \times 16 + 4 = 4660$ and the second input is 22136. Their product is $4660 \times 22136 = 103153760$ which is obtained from the output $5 \times 16^6 + 16 \times 16^5 + \cdots + 52 \times 16 + 32$.