**Lab 7- Documentation Tătar Flavia-Andreea, 937**

*The algorithms used:*

1. *regular O(n2) algorithm*: The multiplication of the polynomials is done by taking every term from the first polynomial and multiplying it with every term from the second polynomial. First we prepare the empty coefficients for the result polynomial and then we take 2 loops to do the multiplications by using the formula: prod[i+j] = prod[i+j] + A[i] \* B[j]
2. *Karatsuba algorithm with complexity O(n^log3):* This algorithm is faster because it uses a Divide and Conquer algorithm for fast multiplication. First we half those 2 polynomials, then we prepare the formula for the multiplication by calculating c0=low A \* low B, c1= high A \* high B, c2=(low A+ high A)\*(low B+high B)-c0-c1, then it comes the calculation of the final result for multiplication by AXB=c1(shifted len\*2) pos + c2(shifted len pos) + c0, where len is the maximum degree/2. Those multiplication signs will be in fact other calls to this function, so here the Divide and Conquer comes in handy by recursive calls.

*The distribution and communication*

*1. regular O(n2) algorithm:* to achieve distributivity we used division of coefficients between processes, each process takes a interval to where it must put the result in the final polynomial result, at first we make the division by sending to the world communicator and then we keep receiving these intervals and make the computations

*2. Karatsuba algorithm with complexity O(n^log3):* to achieve distributivity we used division between the processes for the computations described above, each process would take some coeffs from the first and the second polynomial

*The performance measurements*

1. ***The number of threads is: 3, number of calculators: 3,coeffs number:7***

*Parallel method (simple multiplication): The time passed is: 34 milliseconds*

*MPI method(simple multiplication): The time passed is: 92 milliseconds*

*Parallel method(Karatsuba algorithm): The time passed is: 12 milliseconds*

*MPI method(Karatsuba algorithm): The time passed is: 13 milliseconds*

1. ***The number of threads is: 3, number of calculators: 5,coeffs number:8***

*Parallel method (simple multiplication): The time passed is: 25 milliseconds*

*MPI method(simple multiplication): The time passed is: 94 milliseconds*

*Parallel method(Karatsuba algorithm): The time passed is: 14 milliseconds*

*MPI method(Karatsuba algorithm): The time passed is: 76 milliseconds*

1. ***The number of threads is: 3, number of calculators: 10,coeffs number:9***

*Parallel method (simple multiplication): The time passed is: 13 milliseconds*

*MPI method(simple multiplication): The time passed is: 122 milliseconds*

*Parallel method(Karatsuba algorithm): The time passed is: 12 milliseconds*

*MPI method(Karatsuba algorithm): The time passed is: 36 milliseconds*

*Hardware platform*

Processor: Intel core i5 @1.60 GHz 1.80 Ghz

Available RAM: 7,88 GB

Operating system and processor x64 bit (Windows 10 Education)