

## Algorithm Analysis and Design Lab (CS 312)

### Assignment - 04

Due date: July 29, 2018

- Prob. 1** Implement a *divide-and-conquer* based matrix multiplication algorithm to multiply two square matrices of order  $n \times n$  (assume  $n$  is power of 2).
- Prob. 2** Implement Strassen's algorithm for matrix multiplication.  
Use the following computations.

$$\begin{array}{c|c} A_{11} & A_{12} \\ \hline A_{21} & A_{22} \end{array} \cdot \begin{array}{c|c} B_{11} & B_{12} \\ \hline B_{21} & B_{22} \end{array} = \begin{array}{c|c} C_{11} & C_{12} \\ \hline C_{21} & C_{22} \end{array}$$

**Define 10 matrices:**

$$S_1 = B_{12} - B_{22}, S_2 = A_{11} + A_{12}$$

$$S_3 = A_{21} + A_{22}, S_4 = B_{21} - B_{11}$$

$$S_5 = A_{11} + A_{22}, S_6 = B_{11} + B_{22}$$

$$S_7 = A_{12} - A_{22}, S_8 = B_{21} + B_{22}$$

$$S_9 = A_{11} - A_{21}, S_{10} = B_{11} + B_{12}$$

**Compute  $P_i$  s:**  $P_1 = A_{11}.S_1, P_2 = S_2.B_{22}, P_3 = S_3.B_{11}, P_4 = A_{22}.S_4$

$$P_5 = S_5.S_6, P_6 = S_7.S_8, P_7 = S_9.S_{10}$$

**C components:**

$$C_{11} = P_5 + P_4 - P_2 + P_6, C_{12} = P_1 + P_2$$

$$C_{21} = P_3 + P_4, C_{22} = P_5 + P_1 - P_3 - P_7$$

OR

**Compute  $P_i$  s:**

$$P_1 = (A_{11} + A_{22})(B_{11} + B_{22})$$

$$P_2 = (A_{21} + A_{22})B_{11}$$

$$P_3 = A_{11}(B_{12} - B_{22})$$

$$P_4 = A_{22}(-B_{11} + B_{21})$$

$$P_5 = (A_{11} + A_{12})B_{22}$$

$$P_6 = (-A_{11} + A_{21})(B_{11} + B_{12})$$

$$P_7 = (A_{12} - A_{22})(B_{21} + B_{22})$$

**C components:**

$$C_{11} = P_1 + P_4 - P_5 + P_7, C_{12} = P_3 + P_5$$

$$C_{21} = P_2 + P_4, C_{22} = P_1 - P_2 + P_3 + P_6$$

Submit on or before the due date by sending the necessary files (program file, input file, output file etc.) to [cs312submit@gmail.com](mailto:cs312submit@gmail.com) in a single mail as simple attachments.