

## 8550 Project: Design of Arithmetic Unit and its Complexities Analysis

Due dates:

1. **Thursday Nov 12, 2020** (Group Info)
2. **Tuesday Dec 8, 2019** (Presentation slides)

**Objective:** Applying knowledge acquired from course to design and optimization of a computer arithmetic unit.

### **Project Procedure:**

1. Submit your group information:
  - This is a group-based project. A group can be formed with **up to four students**.
  - Submit a list of group member names along with IDs as in-line text by Nov 12.
2. Choose your project tile by calculating your group code (A, B):
  - Summing up **the last digit in all group members' IDs** to obtain S1. Summing up **the second-to-last digit in all group members' IDs** to obtain S2. Then
$$A = S1 \bmod 4,$$
$$B = S2 \bmod 4.$$
  - For example, Alice and Bob form a group with  
Alice's ID: **103 555 456**  
Bob's ID: **103 555 678**.  
Then  $A = 6+8 \bmod 4 = 2$ , and  $B = 5+7 \bmod 4 = 0$ .  
So Group code:  $(A, B) = (2, 0)$ .
  - If Alice herself alone forms a group, then  
Group code  $(A, B) = (2, 1)$  where  $A = 6 \bmod 4 = 2$ ,  $B = 5 \bmod 4 = 1$ .
  - Find your project title compatible to your group code at the end of this file.
3. Prepare presentation slides:
  - Prepare presentation slides of about 30-40 pages.
4. Submit presentation slides:
  - Submission by Tuesday Dec 8, 2020.
  - Only one copy of project slides needs to be submitted by any one of group members.

### **Requirements and grading standard for project slides, speech and report:**

1. The full marks for the project are 100, which has 30% of course weight.
2. If you use a project topic that is not acknowledged by the professor, there will be a deduction of 50% disregard the quality of your project. On top of that other deductions on quality of work are also possible.
3. While the contents take 90% of weight, the other 10% for the format. In general, there should include cover page, outline/TOC page, and sections of introduction/motivation, design tech review, proposed design, further discussion/recommendation, and references. Don't forget to put page number at each page. Use of multiple figures and tables in ppt is highly recommended. The final file format for submission should be in either ppt or PDF.

**A List of Project Topics:**

- (A, B): This title can be used with any group code.
  - 1) Title: Design of Carry Look-Ahead Adder
  - 2) Requirements: Design a  $(64+A+B)$ -bit carry lookahead adder with complexity analysis. Discuss the efficiency of your design by investigating different architecture/ configuration options with various carry look-ahead levels for trade-offs between circuit complexity and time complexity.
- (A, B): This title can be used with any group code.
  - 1) Title: Design of Carry Save Adder
  - 2) Requirements: Design a carry save adder that takes input of  $(5+A)$  16-bit operands and  $(5+B)$  8-bit operands using FA, HA and possibly logic gates as building blocks. Discuss the efficiency of your design by investigating different architecture/ configuration options with various trade-offs between circuit complexity and time complexity.
- (A, B): This title can be used with any group code.
  - 1) Title: Design of High-Speed Multiplier Unit
  - 2) Requirements: Design a high-speed multiplier that takes two operands of  $(8+A)$ -bit and  $(8+B)$ -bit using FA, HA and logic gates as building blocks. Discuss the efficiency of your design by investigating different architecture/ configuration options with various trade-offs between circuit complexity and time complexity.
- (A, B): This title can be used with any group code.
  - 1) Title: Design of Fast Adder Using BSD
  - 2) Requirements: Design a  $(32+A+B)$ -bit fast adder using BSD (binary signed-digit) number system. Both the two input operands and the output are assumed in BSD form. Discuss the efficiency of your design by investigating different architecture/ configuration options with various trade-offs between circuit complexity and time complexity.