THE UNIVERSITY OF BRITISH COLUMBIA

Department of Electrical & Computer Engineering

October 27, 2005

EECE 256 – Sections 101, 102 & 103

Student name:_____ S#: _____

Midterm – 50 minutes

Closed book – No calculators are allowed

1. Simplify the following Boolean function using only Boolean algebra. Show all your work (Do NOT use truth tables or K-Maps for this question). Implement this function using the **<u>minimum</u> number of 2-input gates**.

$$F = [(D + D') + A + B]' + A'BD + CAB + D'A'B + AB' + ABC'$$

*(20%) – **show all your work.***

2.   Design a binary subtractor which can perform the following operations:

A +B, A-B, -A+B, -A-B
Use Full-Adders and external gates.
*(30%) - **show all your work***

3. You are developing a monitoring system for an automobile to be used for new drivers. The system will be able to log a warning message if the vehicle exceeds a certain speed or if the vehicle is being operated outside of allowed hours. You should assume that the following variables are recorded once the vehicle is turned on: (i) whether the car is in reverse, (ii) whether the car is in drive, (iii) whether the car is turned on outside of the allowed hours for new drivers, and (iv) whether the pre-set speed limit has been exceeded. You may assume that if the car is not in reverse or in drive that it is in park (i.e., it is not moving). You may also assume that exceeding the speed limits for forward and reverse are recorded using the same variable (i.e., there is a limit for reverse too!).

    a.   implement the resulting function using a minimum number of 2-input gates.

    b.   implement the resulting function using the minimum number of 2-input NAND gates.

(25%) *show all your work*

4. Implement the following Boolean function with a 4x1 multiplexer and the **minimum number of 2-input external gates**. Do not assume that complements are available.

$$F(A, B, C, D) = (0, 1, 3, 4, 8, 9, 15)$$

Hint: Two of the inputs are your select lines.

(25%) ***show all your work***