USAF ACADEMY

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING

ECE 281 HOMEWORK 2 LOGIC

DUE: LESSON 7

Name: _____ **Section:** _____

Authorized Resources	You may seek help from any current ECE 281 student or instructor and reference any publication in its completion. Normal documentation is required.
Instructions	▪ Show all work for full credit ▪ Box or circle your final answer. ▪ For all numerical answers, use engineering notation and include units. ▪ Completely label all your diagrams, drawings, graphs, etc. for full credit.

Documentation:

Problem	Value	Earned
1	40	
2	60	
Total	100	

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Problem 1 (40 points) *Word-Problem to Logic Circuit* [Objective 1]

A certain zoo keeper keeps three lions – Showoff, Grumpy, and Lady – that live in a cage consisting of a den and an outside field. Taking care of the lions is no easy task because, being lions, they have the potential to eat people. However, the zoo keeper must, on occasion, enter the lions' den. To help keep himself from becoming lion-chow, he has asked you to design a logic circuit that will turn on a red light if it is not safe to enter the enclosure. (A siren would scare the lions.) Such a system should be easy to design because the lions are only dangerous under certain conditions. Below are the rules:

A. If Showoff is in the den with Lady, he'll eat people if they are in the enclosure.

B. If Showoff is in the den by himself, he'll eat people.

C. If Grumpy is in the den with Lady, he'll try to eat people.

Variables: S, G, and L. These are '1' if the lion is in the den and '0' if the lion is outside.

a. (5 points) Write the logic equation that satisfies each individual condition above

b. (10 points) Write the truth table that shows how all possible inputs (in SGL order, counting *up* in binary) map to outputs.

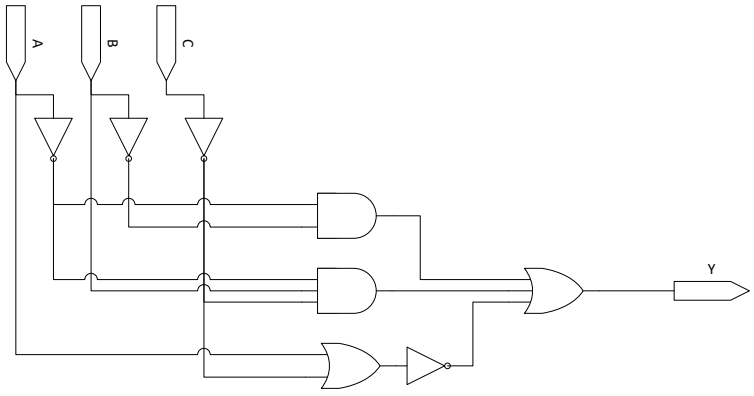
c. (10 points) Write the **Sum of Products** (**SOP)** logic equation (canonical form) that implements the above truth table logic.

Problem continued on the next page…

d. (15 points) Draw a circuit implementation of the SOP logic equation in part c using two-level logic.

Problem 2 (60 points) *Simplifying Logic Circuit* [Objective 1]

Answer the following questions based on the below circuit.



a. (15 points) Write the truth table that shows how all possible inputs map to outputs.

b. (15 points) Write the **SOP** logic equation (canonical form) that implements the above truth table logic.

Problem continued on the next page…

c. (20 points) Use Boolean algebra to simplify the **SOP** logic equation. **Hint:** You should be able to find the correct answer by simply inspecting the truth table (5 pts for correct answer only).

d. (10 points) Draw the simplified circuit.