UIC ECE464 (Fall 2024) Project 1: Fault listing & simulation

Use your favorite programming language to come up with the following functionalities:

A. **Fault listing.**

Read through a circuit bench file named "circ.bench" and generate the full fault list. Print on screen nicely all the stuck-at faults for inputs, internal nodes, and outputs separately. Summarize the total number of faults for this given circuit.

B. **Circ sim.**

Print out the simulation results for the circuit for the following two input vectors:

i. The all-0 vector.
ii. The all-1 vector.

C. **Fault sim.**

1. (any TV any fault) Ask the user for a test vector t and a fault f, and perform fault simulation for t on the circuit with f. Print out all the intermediate result details and conclude whether t can detect f or not.

2. (any TV full fault list) Ask the user for a test vector t, apply fault simulation for the given test vector on each of the fault in the full fault list, output the result whether each fault is detected or not, and finally the total number and percentage of faults covered by this test vector.

D. **(extra credit) Fault coverage study.** Use your program to investigate how fault coverage improves with increased number of test vectors (randomly chosen). For example, for every 10 extra randomly chosen test vectors, how many new faults are detected? Provide a table or plot to show your results on various circuit bench files.

Your program should finish fast for any of the above part. For instance, we expect your program to finish within at most a few minutes even if processing the largest bench files such as c7552.bench.

You can work in a team of 1 – 2 people.

Submission deadline: week 8 Sunday 11:59pm on gradescope with the following:

You can find a list of bench files here: https://replit.com/@raowenjing/464benches

1. (20 pts) Introduction: explain how you implement each of the following functionalities:
    i. Full fault list generation.
    ii. Circuit simulation.
    iii. Fault simulation.

2. (80 pts) Provide (well organized) screenshot pdf files to show the following cases.

    A) (20 pts) Fault listing for:
        i. hw1.bench
        ii. c432.bench

    B) (20 pts) Circ sim with all 0 and all 1 inputs:
        i. hw1.bench
        ii. c880.bench

    C) (40 pts) Fault sim
        1. one TV one fault for c17.bench:
            a. fault 22-10-0 (node 22 with input line 10 stuck at 0) with all 0 input
            b. fault 22-10-0 (node 22 with input line 10 stuck at 0) with all 1 input
            c. fault 22-10-1 (node 22 with input line 10 stuck at 1) with all 0 input
            d. fault 22-10-1 (node 22 with input line 10 stuck at 1), with all 1 input
        2. one TV one fault for hw1.bench:
            a. your choice of t and f, such that t detecting f
            b. your choice of t and f, such that t not detecting f
        3. one TV full fault list for c17.bench:
            a. all 0 input
            b. all 1 input
        4. one TV full fault list for c880.bench:
            a. all 0 input
            b. all 1 input
            c. your choice of t such that t detects as many as possible faults

    D) (extra 5 pts) Fault coverage study
        Show a table or plot for c1908.bench and c7552.bench