Delta Debugging

Question 1. Let c be a failing test case under consideration by the delta debugging minimization algorithm. Which of the following statements is necessarily true?

A. If c is local minimum, it is also global minimum
B. If c is local minimum, it is also 1-minimal
C. If c is 1-minimal, it is also local minimum
D. If c is 2-minimal, it is also 1-minimal
E Whenever c is not 2-minimal, it is also not 1-minimal
F. Whenever c is not 1-minimal, it is also not 2-minimal

Answer: B, D, F

Question 2. A program takes any input that is a string from the alphabet {1,2,3,4} (so the following are possible inputs: "1234", "113112", "21", "4", the empty string, etc). The program fails on the inputs "1234", "14", and the empty string; it does not fail on any others. Suppose we are given the failing input "1234" and seek to minimize it.

Define c_F = {δ_1, δ_2, δ_3, δ_4} where each elementary change δ_x means to keep character x in the input (without altering the order of any remaining characters).

a. Fill in the blanks for the first two iterations of the delta-debugging algorithm in the table below.

Answer:

Iteration	n	Δ	Δ_1, Δ_2, …, Δ_n, ∇_1, ∇_2, …, ∇_n
1	2	1234	12, 34
2	4	1234	1, 2, 3, 4, 234, 134, 124, 123

b. What is the eventual output of the delta-debugging algorithm in this case?

Answer: 1234

Question 3. A program takes any input string consisting of letters a-z and numbers 0-9. The program fails any time the input contains two letters. For example, “123ab678” is a failing input string. Perform delta debugging on this input.

Iteration	n	Δ	Δ_1, Δ_2, …, Δ_n, ∇_1, ∇_2, …, ∇_n
1	2	123ab678	123a, b678
2	4	123ab678	12, 3a, b6, 78, 3ab678, 12b678, 123a78, 123ab6
3	3	3ab678	3a, b6, 78, b678, 3a78, 3ab6
4	2	3ab6	3a, b6
5	4	3ab6	3, a, b, 6, ab6, 3b6, 3ab, 3a6
6	3	ab6	a, b, 6, b6, a6, ab
7	2	ab	a, b

Note: this answer is one of several possible solutions depending on the failing nabla chosen in iterations 3 and 5. All potential solutions will converge at the same minimum “ab” in the same number of iterations.