Homework 1

February 13, 2022

1 Problem 1-1

In the video, there are two methods to calculate the Heron's Formula:

- Method 1:
$$\sqrt{s(s-a)(s-b)(s-c)}, \text{ where } \quad s = \frac{a+b+c}{2} \tag{1}$$
- Method 2:
$$\frac{\sqrt{(a+(b+c))(c-(a-b))(c+(a-b))(a+(b-c))}}{4}. \tag{2}$$

With given $a = 9.00$ and $b = c = 4.53$, **calculate that the area A is equivalent to** 3.04 **by using** (1) **and** 2.35 **by using** (2)**.**

- To get $A = 3.04$ from (1), you should calculate s by
$$s = \frac{a+(b+c)}{2}.$$
- Note that for multiplication and square root we assume that exact calculation can be done and results are rounded.

2 Problem 1-2

In problem 1-2, we explore more catastrophic cancellation examples. Check Eq. (13) of the following paper and line 213-216 in tron.cpp from the software package LIBLINEAR version 2.11. Explain how we avoid catastrophic cancellations.

- Paper: `http://www.csie.ntu.edu.tw/~cjlin/papers/logistic.pdf`
- LIBLINEAR version 2.11: `http://www.csie.ntu.edu.tw/~cjlin/liblinear/oldfiles`

Note: We do not consider the latest version of LIBLINEAR because this segment of code has been removed.

3 Problem 1-3

Let us see another cancellation example. On page 5, line 12 of the paper

`http://www.csie.ntu.edu.tw/~cjlin/papers/plattprob.pdf`,

there are two methods to calculate $1 - p_i$, and the results may be different under some conditions. Please repeat the example and discuss what you found.