

The Avengers are trying to figure out why certain combinations of superheroes seem to work together better than others. They start analyzing all their past battles and start keeping track of which Avengers helped out in which battles, and whether the battle was won or lost.

They come up with the following information:

In the last 10 battles, they won 6 of them but lost 4.

In the 6 that they won, Iron Man fought 4 times, Thor fought 2 times, and Black Widow fought 5 times.

In the 4 that they lost, Iron Man fought 3 times, Thor fought 1 time, and Black Widow fought 2 times.

The Avengers (naturally) assume that the presence or absence of any of their members is conditionally independent of the presence or absence of any other member, given that the battle is already won or lost.

Suddenly, the Avengers are alerted that Thanos is about to wipe out half of all life in the universe. Iron Man and Black Widow are available, but Thor is busy and can't make it. Help the Avengers build a Naïve Bayes classifier to determine if a battle with Iron Man and Black Widow but no Thor is enough to defeat Thanos! (Whether the battle is more likely to be won or lost.)

Then, use your knowledge of probability to determine the posterior probability that the battle will be won.

Note: You should smooth the probabilities of the features given the classes, but not the priors.