TML Assignment 1

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Problem 1:

- Everything of this problem is in directory '1'.
- Codes of algorithms are given in respective files.
- Plots with standard error bars are given in 'plots' directory.
- Plot files have names of form `[1, 2, 3]_[ucb,exp3,eg1,eg2]_[r,io]` where
  - [1, 2, 3] denotes problem1(0.9, 0.6), problem2(0.9, 0.8) or problem3(0.55, 0.45).
  - [ucb,exp3,eg1,eg2] refers to algo names(eg1 means epsilon greedy with epsilon as 0.01 and eg2 for epsilon 0.1)
  - [r, io] is plot type. `r` means regret and `io` means fraction of times optimal arms played.
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- We can see that all algo performs according to their theoretical bounds.
- UCB performs best as per theoretical bound.
- In epsilon greedy, 0.01 epsilon value is better than 0.1
- EXP3 performs worst because that algo assumes adversarial scenario which increases the regret.

Problem2

- Part1 :
  - Perceptron and Winnow both performs almost equal. By different values of eta(learning rate), performance changes a bit. But both of them achieves near 85% accuracy.
  - By setting empirically optimal values of eta, winnow performs slightly better
- Part3:
  - Introduction of corrupted data induces noise and possibly break the linear separability of the data. Thus we see reduction in overall performance of both algo.
- Part2

    - After preprocessing, vocabulary of 7777 words is used.
    - Data is nicely linearly separable and both the algo achieves around 97% accuracy.
    - By setting empirically optimal values of eta, perceptron performs slightly better. By algorithmically, eta for perceptron is taken as 1. In that case, winnow performs better. (We can set the eta value and check)

Problem 3

- Starting part of the bound proof is given. With eps probability, all arms will have the chance to be picked up and hence their delta will be added in regret.
- For (1-eps) probability, best arm will be chosen, i.e. the one with best running mean
- By applying hoeffding's lemma and following something similar to ETS regret bound proof, we can get bound for eps greedy.