The goal of this homework is to get you familiar with the Shifting Expert Framework and Matlab. You are to implement some on-line learning algorithms in relation to the long-term memory effect and plot various performance curves.

Do one of the following 2 problems. The first one is the easiest. We sort of know what to expect and have lots of material to help you along. For the second one there is also basic and you have a paper to go by. The third one is newer to us and has more of a research flavor.

1 Diskspindown Problem

Base task:
Implement the disk idle time prediction algorithms given in original paper (see link for Lecture 2).
Plot the total energy usage of the master algorithm, the individual experts, and the optimal algorithm. For your master algorithm use the exponential update with the loss function given in the paper followed by one of the mixing updates.
Plot the weights of the experts over time.
Summarize your results in a short report. In particular, carefully describe your plots and the versions of the updates used.

Besides the base task you should do at least one of the following:

- Study the effects of using different sets of fixed time outs as experts and different learning rates
- Try different mixing updates (Fixed share to start vector / fixed share to uniform past / fixed share to decaying past with polynomial decay / fixed share to decaying past with exponential decay / variable share updates).
- Try the 2 track markov update described in Bless/Curse page 281 onward.
- Try the following idea. Use the loss update and one of the share updates, but do not predict with the weighted average. Instead predict with the expert of largest weight.
- In the original paper each expert is a fixed time out strategy. Use other simple rules of thumbs as experts
- Make up artificial data sets (As in the [BW] paper) to study the effects of different share updates
- Computer the best shift curve and compare your algorithm’s performance to this curve
- Any other idea you might have

Be sure to visualize your results and remember, presentation is what counts.
The data is accessible via a link from the web page. Good parameter values can be gleaned from the talks and papers.
Begin by reading the original Spin Down paper and "Shifting Expert’s" papers as much as possible.

2 Building a caching strategy from a number of base strategies

Implement the algorithms discussed in class. The setup is more involved. Only suggest this topic if you have some experience with implementing on-line algorithms in Matlab.
My ex grad student Nie Jiazhong can help with implementation questions.
He also has good data for the caching application.