Homework for CS 789, Spring 2011

Exercise 2.1 *Partition the following sequence into* 4*-phases by inserting bars:*

a b d e b a b c f d e g b d a a b c c f g h e b c d b c a b e c b e b c

Exercise 2.2 *What is LRU's cache at the end of the sequence given above?*

Exercise 2.3 *Find an example sequence to prove that the competitiveness of* MARK *for* $k = 3$ *is not less than* $2H_3 - 1$.

Hint: According to a theorem mentioned in the textbook, MARK is H_k competitive if the number of pages in the system is $k + 1$. So your example must have more than 4 pages.

Exercise 2.4 *Prove that the lazy watchman is not competitive.*

Exercise 2.5 *Prove that the eager watchman is 2-competitive.*

Exercise 2.6 *Prove that the cautious watchman is 2-competitive.*

Exercise 2.7 *Prove that no deterministic watchman can have competitiveness less than 2.*

Hint: use the cruel adversary.

The *memoryless random* watchman stays in his chair if the nearby light blinks. If the far light blinks, he flips a coin. With probability $\frac{1}{2}$, he stays, and with probability $\frac{1}{2}$, he moves. This strategy is called *memoryless* because it utilizes only current information, *i.e.,*his current configuration and the current request, and makes no use of data from the past.

Exercise 2.8 *What is the competitiveness of the memoryless random watchman?*

The *barely random* watchman flips a coin when he is hired. With probability $\frac{1}{2}$, he is cautious his entire career, and with probability $\frac{1}{2}$, he is eager his entire career.

Exercise 2.9 *Prove that, against the oblivious adversary, the barely random watchman is* $\frac{3}{2}$*-competitive.*