

CS 654 Homework 1
Due: September 16, 11:59 pm
By emailed PDF

1. (40pt) Your company's internal studies show that a single-core system is sufficient for the demand on your processing power. You are exploring, however, whether you could save power by using two cores.
 - (a) (10) Assume your application is 70% parallelizable. By how much could you decrease the frequency and get the same performance?
 - (b) (10) Assume that the voltage may be decreased linearly with the frequency. Using the equation in Section 1.5, how much dynamic power would the dual-core system require as compared to the single-core system?
 - (c) (10) Now assume the voltage may not decrease below 70% of the original voltage. This voltage is referred to as the "voltage floor," and any voltage lower than that will lose the state. What percent of parallelization gives you a voltage at the voltage floor?
 - (d) (10) Using the equation in Section 1.5, how much dynamic power would the dual-core system require as compared to the single-core system when taking into account the voltage floor?
2. (30pt) In a server farm such as that used by Amazon or the Gap, a single failure does not cause the whole system to crash. Instead, it will reduce the number of requests that can be satisfied at any one time. Assume that the FIT for a single computer is 300 failures per one billion hours.
 - (a) (15) If a company has 20,000 computers, and it experiences catastrophic failure only if 2/5 of the computers fail, what is the MTTF for the system?
 - (b) (15) Assume that the MTTR for any single computer is 2 days, and that all computers are equally and fully loaded (which is not true). If Amazon's quarterly income is \$2.98 billion (4th qtr 2005), how much money is lost, per day, to computers failing?
3. (30pt) Solve exercise 1.18 (a.,b.,c., and d., but not e.) from the book.