ECEn 528
Study Guide – Leakage Reduction and DVFS

- Read Chapters 3 and 5 of *Computer Architecture Techniques for Power-Efficiency*
  - Things to focus on
    - Why DVFS can help (3.1)
    - Don't worry about 5.3.4 - 5.3.6
  - Clarifications
    - none
  - Answer the following questions:

1. What three elements of leakage are targeted by different leakage control techniques?

Stacking effect/gated Vdd; Drowsy effect/scaling supply voltage; scaling threshold voltage

2. Why does power-gating the functional units after a branch misprediction not affect performance?

They are immediately powered down after a misprediction

3. What questions must be addressed to perform DVFS?

What level should the DVFS control policies operate; how will the DVFS settings be selected and orchestrated; what is the hardware granularity at which v,f can be controlled; how do the implementation characteristics of the DVFS approach being used affect the strategies to employ; how does the DVFS landscape change when considering parallel applications on multiple-core processors

4. Why do the different techniques (system-level vs. program-level vs. MCD) show such wide variations in power savings and performance impact?

system-level: 5-75% power reduction
program-level: offline: 28% energy savings, 5% performance loss
online: 6-22.4% EDP improvement
MCD: 10% power reduction, 5-15% performance impact

They're pretty different approaches to the problem

5. What are the pros and cons of offline vs. online DVFS analysis?

Offline is tempting to carefully plan and optimize use of DVFS because doing so costs time and energy
Offline lacks knowledge about runtime characteristics such as data inputs and caching behavior