ECE 3030: Physical Foundations of Computer Engineering
Fall 2022
Homework 1—Total points 100
Due on Tuesday 8/30/2022 at 11.59am.

Q1 The following figure shows how the microprocessor clock frequency evolved over the last four decades. Note that clock frequency stopped increasing after 2005. Explain why. [40 pts]
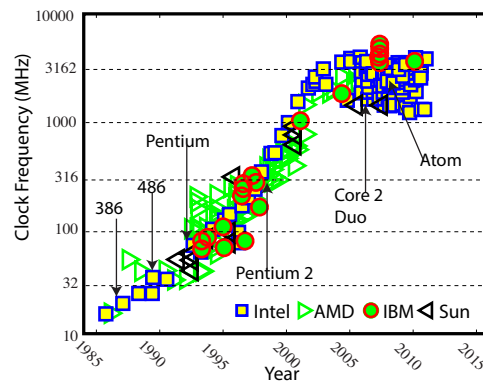

Figure 1: Ref: Andrew Danowitz et al. CPU DB: recording microprocessor history. In: Communications of the ACM 55.4 (2012), pp. 55-63.

Q2 The Moore's law is an observation that the number of transistors per square area of a state-of-the-art microprocessor chip doubles approximately every two years. This has remained valid since early 1970s till now. How is that achieved while the size of the chip has remained almost the same? Why is it advantageous? [30 pts]
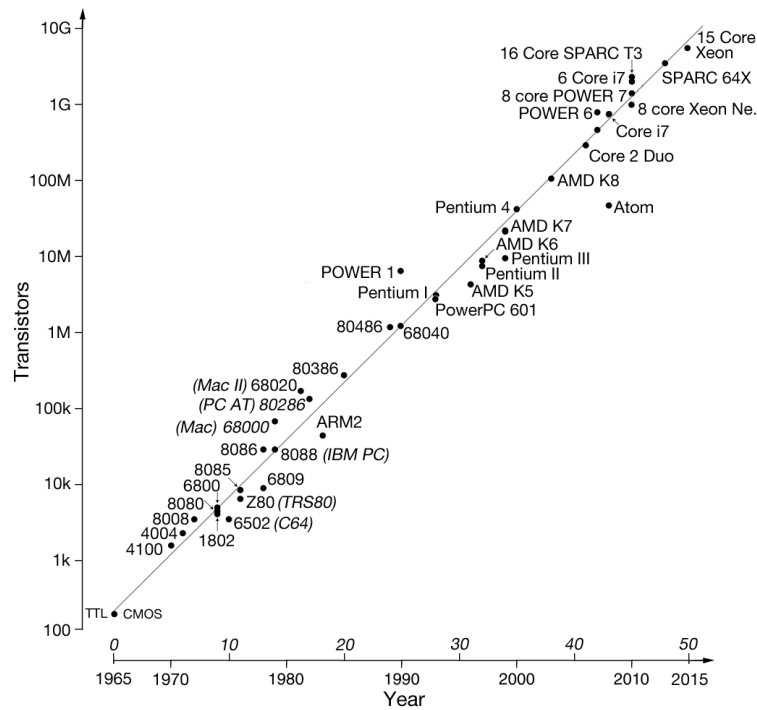
1

Figure 2: Ref: https://www.elektormagazine.com/articles/moores-law

Q3 What is the largest transistor count in a microprocessor? [Apple A14 Bionic chipset in iPhone 12 has ~11.8 billion transistors. There are other chips with higher transistor counts.] [30 pts]