

ECE471: Embedded Systems – Homework 10
Power/Performance

Due: Friday, 11 December 2020, 10:00am EST

Power and Energy

Table 1: OpenBLAS HPL N=10000 (Matrix Multiply)

Machine	Processor	Cores	Frequency	Idle Power	Load Power	Time	Total Energy
Raspberry Pi 2	Cortex-A7	4	900MHz	1.8W	3.4W	454s	1543J
Dragonboard	Cortex-A53	4	1.2GHz	2.4W	4.7W	241s	1133J
Raspberry Pi 3	Cortex-A53	4	1.2GHz	1.8W	4.3W	178s	765J
Jetson-TX1	Cortex-A57	4	1.9GHz	2.1W	13.4W	47s	629J
Macbook Air	Broadwell	2	1.6GHz	10.0W	29.1W	14s	407J

- Table 1 shows the energy use of various machines when doing a large Matrix-Matrix multiply.
 - Which machine has the lowest under-load power draw?
Pi 2
 - Which machine consumes the least amount of energy?
Broadwell Macbook Air
 - Which machine computes the result fastest?
Broadwell Macbook Air
- Consider a use case with an embedded board taking a picture once every 60 seconds and then performing a matrix-multiply similar to the one in the benchmark (perhaps for image-recognition purposes). Could all of the boards listed meet this deadline?
No, only the Jetson and Macbook Air can meet the deadline
- Assume a workload where a device takes a picture once a minute then does a large matrix multiply (as seen in Table 1). The device is idle when not multiplying, but under full load when it is.
 - Over an hour, what is the total energy usage of the Jetson TX-1?
Each Minute = (13s Idle * 2.1W) + (47s Load * 13.4W) = 657J
Each hour = 60*657 = 39,426J
 - Over an hour, what is the total energy usage of the Macbook Air?
Each Minute = (46s * 10W) + (14*29.1) = 867J
Each hour = 867*60 = 52,044J
- Given your answer in the previous question, which device would you choose if you were running this project off of a battery?
Jetson-TX1. In general the lowest energy will lead to best battery life, although this can be complicated depending on the battery's characteristics and the device's peak power draw