CEG 3156: Computer Systems Design (Winter 2024)
Prof. Rami Abielmona
Possible Solutions to Quiz #3: Memory Hierarchy

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Instructions

This quiz will last 35 minutes. **Please complete the below question**, and answer to the best of your ability. State any assumptions and acronyms that are utilized in the quiz, and do not forget to submit your answer on Brightspace.

Question I

Design a direct-mapped cache with 128 KB that uses 32-bits and 16 bytes per block. Calculate:

- How many bits are used for the byte offset?
- How many bits are used for the index field?
- How many bits are used for the tag field?

- 16 bytes per blocks 16 = 2^4, 4 bits to indicate the byte offset
- 128 KB cache or 128 x 1024 bytes = 2^7 x 2^{10}, 2^{17}. Direct-mapped cache means 1 block per index. 2^{17} / 2^4 bytes/block = 2^{13}, hence 13 bits for the index field
- 32 total bits for an address, 32 - 13 index bits - 4 offset bits = 15 bits for the tag field