

# Quiz - Lecture 23

**Due** 21 Oct at 23:59    **Points** 5    **Questions** 5    **Available** 20 Oct at 9:10 - 21 Oct at 23:59 1 day  
**Time limit** None    **Allowed attempts** Unlimited

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## Attempt history

	Attempt	Time	Score
KEPT	<a href="#">Attempt 2</a>	1 minute	5 out of 5
LATEST	<a href="#">Attempt 2</a>	1 minute	5 out of 5
	<a href="#">Attempt 1</a>	6 minutes	1.3 out of 5

Score for this attempt: **5** out of 5

Submitted 20 Oct at 12:04

This attempt took 1 minute.

### Question 1

1 / 1 pts

What effects would adding instruction and data caches have on how fast a Hack computer could run programs?

**Correct!**

- ☒ Programs that execute a lot jumps would run slower.
- ☐ All programs would run faster.
- ☐ Programs that repeatedly access the same data would run faster.
- ☐ Programs that repeatedly execute the same instructions would run faster.

**Correct!**

- ☒ Everything would run slower.

**Correct!**

- ☒ Programs that randomly access memory would run slower.

The Hack computer runs off a single clock signal so every instruction takes the same length of time to execute. The clock must be slow enough to allow the longest path through the computer to complete in a single clock cycle. Adding instruction and / or data caches to the Hack computer would just make the longest path longer, the clock cycle would need to be longer and the clock would have to run slower. Therefore every instruction would take longer to execute and every program, regardless of what it is doing, would run slower.

**Question 2****1 / 1 pts**

Which of the following kinds of program would benefit from an instruction cache?

**Correct!**☒ A million line numerical analysis application**Correct!**☒ An assembler**Correct!**☒ A random number generator**Correct!**☒ A compiler**Correct!**☒ A program that randomly accesses more data than fits into memory

Almost every kind of program benefits from an instruction cache.

**Question 3****1 / 1 pts**

Which of the following kinds of program would benefit from a data cache?

**Correct!**☒ A compiler**Correct!**☒ An assembler**Correct!**☒ A sorting program using quicksort

Quicksort is extremely fast because of data caching.

**Correct!**☐ A program that randomly accesses more data than fits into memory☒ A random number generator**Correct!**☒ A million line numerical analysis application

Most programs benefit from a data cache but poor memory access patterns can result in very poor performance.

**Question 4****1 / 1 pts**

Which of the following are examples of temporal locality that may occur when a program is being executed? Select all that apply.

☐ A group of functions that are all called within a short space of time.**Correct!**☒ Instructions that are used soon after they were last used.**Correct!**☒ Data that are used soon after they were last used.☐ A collection of data that are all used within a short space of time.

Temporal locality arises when something that is used is used again in the near future. The instructions in a loop are a good example, the same instructions are used on each iteration of the loop. Another good example is the top of a stack when items are continually being pushed onto and popped off. Only a relatively smaller number of memory locations are needed to store the stack and they are continually being reused.

Caches take advantage of this by keeping a copy of data being accessed to increase the chances that when it is accessed again it will be found in the cache.

### Question 5

1 / 1 pts

Which of the following are examples of spatial locality that may occur when a program is being executed? Select all that apply.

Correct!

☒ Data that are used soon after nearby data were last used.

Correct!

☒ Instructions that are used soon after nearby instructions were last used.

☐ A group of functions whose instructions are all stored close together in ROM.

☐ A collection of data that are all stored close together in memory.

Spatial locality arises when something that is used is near to something that will be used in the near future. Instructions are a good example, except for jumps, the next instruction to be executed is stored next in ROM. Another example would be sequentially accessing an array. When an array element is accessed the next array element to be read is the next one in RAM.

Caches take advantage of this by reading a block of data around the ROM / RAM being accessed to increase the chances that a future access will be found in the cache.

Quiz score: **5** out of 5