



The purpose of the simulation exercise is to give the students a small taste of what it is that computers do.

The single-most important “take-away” from this exercise is:

The computer had no idea what was being drawn on the display - it was just mindlessly following the instructions in the program.

Computers do not “understand” what they are doing. Drawing a picture of a cat is the same (from the computer’s perspective) as drawing a picture of a dog - it’s just a series of instructions to execute.

Since computers are simply executing the instructions in the program, it is the programmer’s responsibility to write the program correctly. If there is a mistake in the program, the computer will still go ahead and try to execute the program as written.

Questions

Some of these questions are not simple, and will test understanding. Some are more for teacher consideration than for the students. Feel free to contact us (education@icrar.org) to discuss them.

1. What happens if the CPU tells the display to plot an x or y value that is greater than 9?
 - It could be ignored (not drawn)
 - It could report an error
 - It could be drawn in some other part of the screen
 - On some systems, plotting a large x value would draw the pixel at the beginning of the next row.
2. How could we improve the speed of the program?
 - What is the slowest task?
 - How can we speed up the searching of the disk/colours?
 - Build an Index? - Computers and Libraries do this
 - Build a Cache to remember previous values? Modern computers have many levels of Cache to remove the need to go to disk
 - What about the order of the instructions? Could we change them?
 - Out of order execution is used by all modern CPUs to reduce the wait time
 - What about the instructions that do nothing?
 - In a real computer Compiler optimisers remove these
 - What about adding more people?
 - Parallel execution (many CPUs, and ALUs)
 - Parallel Disks
 - But only one screen - how do we get the data to the screen correctly?
3. What happens if the CPU is faster than the display or the disk?
 - On a real computer system, the CPU generally doesn’t wait for the display, so the display will either queue up the drawing commands (and seem sluggish as it struggles to catch up) or it will drop some of the commands (and the display will not be accurate).
4. What happens if the display is faster than the CPU?
 - Then it sits around waiting for the next drawing command. This is preferable to the previous situation since the display will always be accurate.
5. What would happen if the Teacher was the only person with the colour book? How could all the CPUs access the data?
 - This is a network drive and requests are queued. You could try this in the classroom!
6. What happens if you make a mistake? How can you correct it?
 - This is called debugging (<https://en.wikipedia.org/wiki/Debugging>)