MATR326 Tools of high performance computing 2024

Exercise 1

Submit by Monday 22.1.2024 23:59 to Moodle
Exercise session: Tuesday 23.1.2024

Problem 1. *(6 points)*

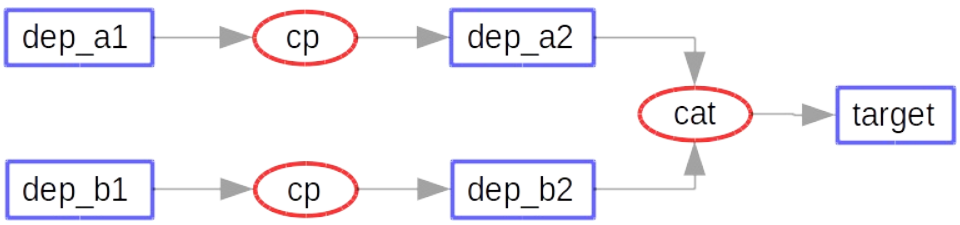
Linux systems have a pseudo-filesystem[1] mounted on /proc. One file on this filesystem is called /proc/cpuinfo. As its name says, it contains information on the system CPUs. Your task is to find out the clock frequency of at least one Linux system. Note that the power saving features of modern computers adjust the clock frequency if there is no load. This means that while checking the content of file /proc/cpuinfo you should simultaneously run a program that uses the cpu(s). Report also the CPU model name.

Problem 2. *(6 points)*

The accompanying bash script `get_freq` prints the clock frequencies (in MHz) of all the CPU cores[2] with 1 second intervals. The number of samples is given as the first and only command line argument. Run the script at least with 100 samples and report the average frequency and its standard deviation for all cores.

Problem 3. *(6 points)*

The `make` system can be used to describe dependencies between any files, not only for compilation of programs. Figure below shows dependencies[3] between files `deb_a1`, `dep_a2`, `dep_b1`, `dep_b2`, and `target`.



Red ellipses describe the command that must be executed in order to fulfill the dependencies (i.e. `dep_a2` is a copy of `dep_a1` and `target` contains files `dep_a2` and `dep_b2` concatenated). Note that you should also give commands that create files `dep_a1` and `dep_b1` and put some content into them.

Write a Makefile that describes these dependencies and demonstrate its workings first by starting from scratch (none of the files exists) and then by e.g. touching[4]

1 See the documentation with command `man 5 proc`.
2 If hyperthreading is on the number of cores in `/proc/cpuinfo` is twice the number of physical ones.
3 The object where the arrow points depends on the object from which the arrow starts.
4 Command `touch` changes the time stamp of a file. Remember that `make` system bases its operation on the time stamps of files.

one of the files.

Problem 4. *(6 points)*

Demonstrate what happens when you have a circular dependency like the one shown below.