Exercise sheet 3 – Hardware performance

Goals:

- Basic knowledge about performance measures
- Practical benchmarking: Popular benchmarking suites and tools (CPU, (GPU), Memory, IO, Network)

Exercise 3.1: Clock cycle time

(a) Calculate the clock cycle time `t_CC (s)` of the Intel i9-11980HK processor at its base frequency (configurable TDP-up base frequency). You may find the CPU specification somewhere in the internet.

(b) How many ADD instruction could theoretically be performed within one second, if an ADD instruction takes 0.25 cycles (according to `https://www.agner.org/optimize/#manual_instr_tab`)?

(c) How do the calculated numbers change, if the Intel i9-11980HK runs on its max turbo frequency?

Exercise 3.2: Time measurement and speed up

(a) Inspect the source in `sheet_03_performance/time_measurement/main.c`

(b) Compile the source in `sheet_03_performance/time_measurement` with: `gcc -O0 ...`

(c) Measure the time (real) when executing the compiled program.

(d) Repeat the compilation and time measurement with: `gcc -Ofast ...`

(e) Calculate the speedup.

Exercise 3.3: Popular benchmarking suites

(a) Use `geekbench5` to benchmark your CPU. You can download it from: `https://www.geekbench.com/`

(b) Who has the highest single core and multi core score?

(c) Use PassMark PerformanceTest to benchmark your CPU. You may install the `libncurses5` library first. You can download it from: `https://www.passmark.com/products/pt_linux/index.php`

(d) Who has the highest integer and floating point MOPS?

Exercise 3.4: CPU benchmarking

(a) Use `7z` to benchmark a single core on your CPU

(b) Use 7z to benchmark all cores on your CPU

(c) Who has the highest single core and multi core MIPS value?

Exercise 3.5: Memory benchmarking

(a) Use sysbench to benchmark your memory with a single thread.

(b) Who has the highest single core memory throughput?

Exercise 3.6: IO benchmarking

(a) Use `fio` to benchmark the read throughput (without buffers) of your storage medium (HDD, SSD).

(b) Use `fio` to benchmark the write throughput (without buffers) of your storage medium (HDD, SSD).

(c) Who has the highest read/write IO throughput?

Exercise 3.7: Network benchmarking

(a) Use `speedtest-cli` to measure the internet speed.

(b) What is the ping and the throughput?

(c) Optional: If you have Linux on your host: Use `wavemon` to measure the WLAN quality.

Exercise 3.8: Windows or macOS benchmarking

(a) Find and test similar tools for Window or macOS:

- CPU
- GPU
- Memory
- IO
- Network