**Task 3: Parallel Programming Skills**

1. **Foundation**

**The components on the raspberry PI B+ are:**

Two USB ports, 2 power ports, a camera, HDMI port, ethernet Controller, ethernet port, CPU/RAM, and a display port.

**Raspberry PI’s B+ CPU have:**

The Raspberry PI’s B+ CPU has 4 cores.

**The three main differences between INTEL x86 (CISC) and ARM Raspberry PI (RISC) are:**

1. The CISC has a larger and more feature rich instruction set, which allows several complex instructions to access memory with more operations.
2. CISC uses little-endian format for storage.

3) CISC has more addressing modes but less registers than RISC.

1) RISC has a simplified instruction set (Which helps to execute the program quickly.), with more general-purpose registers than CISC.

2) RISC’s instructions only operate on registers and uses to Load and Store for memory access.

3) RISC is stored with BI-endian (it can switch between small and big endian).

**The difference between sequential and parallel computation and its practical significance of each are:**

As we know software is written for serial computation. The problem is categorized into discrete series of instructions and executed on a single processor and it allows only one instruction to execute at a time. The practical significance of sequential computing is the ease of writing instructions.

Parallel computing is the instantaneous use of multiple compute resources to solve a computational problem. The problem is categorized into series of instructions that can be executed parallelly in different processors. The practical significance of parallel computing is the speed at which instructions are executed.

**The basic form of data and task parallelism in computational problems are:**

Data parallelism refers to a broad category of parallelism, in which same computation (tasks) is applied to multiple data items in different cores.

Task Parallelism is used where parallelism is organized around the functions to be performed rather than performing on the data around it. In simple words, it allows to compute one task on one core and another task on another core.

**The differences between processes and threads are:**

Processes means when the program runs, they do not share memory with each other, and they operate one per core. Whereas threads are easy processes that allow executables to be decomposed into independent parts and they share a common memory with the process to which they belong.

**OpenMP and OpenMP pragmas means:**

OpenMP is an application programming interface which uses an implied multi-platform model in which the library handles thread creation and management and makes the programmer’s task simpler.

OpenMP pragmas is the compilers directive that enables the compiler to generate threaded code.

**Applications that benefit from multi-core are:**

Applications that benefit from multicore usage include are not limited to database servers, scientific applications (CAD/CAM), multimedia application, and web servers.

**Multicore is used because:**

Multi cores can operate running multiple processes at the time while single core can only operate one process at the time, which reduces the time to complete the task and increases the output of the system. Speeding up the clock frequencies in single core is difficult due to heat problems, maximum speed of light, and costs. Lastly, many new applications are multithreaded to utilize multicores.

1. **Parallel Programming Basics**

🡪This is a C program to get familiar with special kind of editions in OpenMP, which allow to run the parts of a given program on multiple threads of a multicore machine, which is shown in the following program.

🡪When I first ran this example did not run as expected it showed that the first iteration of the code was that int id was declared in main method. The id appeared more than once in the output or when program was executed.

🡪As all the cores share the same memory, it cannot have multiple variables with the same id.

🡪 I then referred to the given instructions to solve the program. After it was fixed the difficult lines with full variable declarations were done and it executed successfully as expected.

The program when ran for the first time.

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After fixing the problem:

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