High Performance Computing
Homework 9

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For this assignment, the **Linear Search** and **Binary Search** algorithms were implemented in the Fortran module file, **searchutils.mod.** This module is used in the **main_program.f90** script, which was compiled with the **make** command and executed through the **./main_program.exe** command. The results of the execution were saved into the **results.txt** file and are shown in Figure 1.

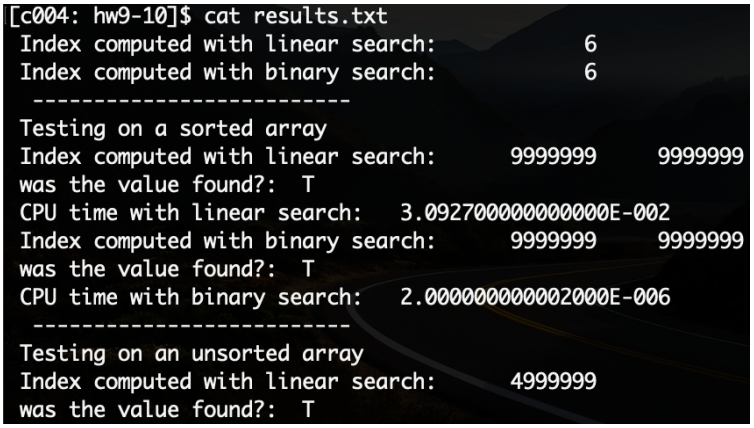

Figure 1. Results from the compilation and execution of main_program.f90.

These algorithms iterate through arrays to identify the position of a value that matches a number that has previously been specified. The implementation was successful in 3 different cases, as shown in the previous figure, where Case 1 uses a small sorted array, Case 2 uses a large sorted array, and Case 3 uses a large unsorted array. Both the **Linear** and **Binary Search** algorithms were used in Case 1 and 2. However, only the **Linear Search** algorithm was used in Case 3, as **Binary Search**'s implementation requires the array used to be sorted.

The CPU times for the Case 2 are reported in
Table 1. It may be observed that the **Linear Search** takes more CPU time to complete. The speed up factor between the 2 algorithms is 15463.5. This is possibly due to the fact that the **Linear Search** needs to iterate through the entirety of the array, whereas the **Binary Search** systematically disregards chunks of the array as it searches for the value, increasing its efficiency. However, this last approach presents the disadvantage of having to sort the array before the search is executed.

Table 1. CPU time for Case 2.

Algorithm	CPU Time [s]
Linear	3.092700000000E-02
Binary	2.000000000002E-06