Brian Bowles

CS 5050

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**Algorithm & Problem Summary**

Although the divide and conquer algorithm still calculates all of cache, like the dynamic programming algorithm, it is more space efficient at doing it, which is why it is used. Dynamic programming algorithms are more time efficient than the divide and conquer because it does less calculation, but for application like DNA testing space is a bigger deal than time. The reason space needs to be saved for algorithms like the DNA sequencing is because DNA sequence are rather large and we are limited to the amount of RAM on whatever machine is running the algorithm. In most cases there is more than one way to solve a problem, but finding the most efficient way to solve a problem using the limited resources given is a big part of Computer Science and problem solving in general. When analyzing which algorithm one should use they should ask themselves what is more important in the context of this problem, space or time?

**Maximum Size for Naive Algorithm O(n^2)**

* Assuming 4 bytes per integer in cache
* RAM is equal to 2,000,000,000 bytes
* Assuming n and m are equal for simplicity when calculating maximum size
* Max size = RAM Space (bytes) / # of bytes per integer

x^2 = 2,000,000,000 bytes / 4 bytes = 500,000,000

500,000,000^(½) = 22,360.67977

Max size(x) = 22,360, assuming nothing else in the program is taking up space in RAM.

* The program did run the prototypical human vs neanderthal test using the naive algorithm without crashing and calculated the same score as the divide and conquer algorithm. These two sequence were about 16,200 character each.

**Diverse Study Table**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Chinese | Ethopian | French | Ingman Australian | Italian | Japanese | Mishmar Caucasian | Native American | Navajo | Spanish |
| Chinese |  | 82554 | 82659 | 82614 | 82643 | 82512 | 82556 | 82555 | 82556 | 82610 |
| Ethopian | 82554 |  | 82659 | 82693 | 82667 | 82605 | 82622 | 82648 | 82628 | 82619 |
| French | 82659 | 82695 |  | 82693 | 82636 | 82598 | 82577 | 82617 | 82625 | 82574 |
| Ingman Australian | 82614 | 82693 | 82693 |  | 82636 | 82520 | 82475 | 82723 | 82509 | 82486 |
| Italian | 82643 | 82667 | 82636 | 82636 |  | 82520 | 82475 | 82723 | 82509 | 82486 |
| Japanese | 82512 | 82605 | 82598 | 82520 | 82520 |  | 82475 | 82518 | 82526 | 82517 |
| Mismar Caucasian | 82556 | 82622 | 82577 | 82564 | 82475 | 82475 |  | 82518 | 82552 | 82529 |
| Native American | 82555 | 82648 | 82617 | 82563 | 82723 | 52518 | 82518 |  | 82552 | 82535 |
| Navajo | 82556 | 82628 | 82625 | 82557 | 82509 | 82526 | 82552 | 82552 |  | 82535 |
| Spanish | 82610 | 82619 | 82574 | 82486 | 82486 | 82517 | 82529 | 82535 | 82535 |  |

**Human Vs. Great Apes Study Table**

|  |  |
| --- | --- |
|  | Prototypical Human |
| Baboon | 56900 |
| Bonobo | 67851 |
| Chimpanzee(8) | 67720 |
| Chimpanzee(9) | 67754 |
| Gorilla | 66156 |
| Western Lowland Gorilla | 66122 |