COP5615
Distributed Operating Systems Principles
Project #1

Kaustubh Bapat
Indrajit Shanbhag

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Implementation

The implementation creates one supervisor. This supervisor spawns one
SequenceResultTask worker that waits on getting results from different
workers that evaluate different sequences. The number of worker units
that individually evaluate different sequence is decided based on the
value of N

For N <= 1000, the size of work unit is N,

For N>1000 and N<=10000, the size of work unit is N/10, and

For N>10000, the size of work unit is determined by k and is N/k. If N
and k are equally large, the number of workers will be very large. We
observed that large number of workers doesn't necessarily mean better
performance hence, for N>10000 the code evaluates a simple max()
operation

$$max(div(N,k), div(N,100))$$

which can spawn a maximum of 100 workers.

The different worker spawning conditions implemented ensures that for
varied combinations of N and k, the number of workers spawned is not
excessively large.

For example, for N > 10000, the first worker when created, is assigned
the numbers $1 \rightarrow (N/k)+1$, the next worker is assigned numbers $(N/k)+2 \rightarrow 2(N/k)+2$, and so on.

Thus, the first worker evaluates sequences:

seq 1: $1^2 + 2^2 +.....+ k^2$
seq 2: $2^2 + 3^2 +.....+ (k+1)^2$
...
...
...
seq (N/k)+1: $((N/k)+1)^2 + ((N/k)+2)^2 +.....+ ((N/k)+k+2)^2$

Furthermore, the logic of calculation uses the formula:

$$\frac{p(p+1)(2p+1)}{6} - \frac{(q-1)(q)(2q-1)}{6}$$

{ where calculation is for sequence q, q+1,.........,p-1,p in the sequence
1,2,3,.......q-1,q,q+1,......,p-1,p }

to evaluate the sum of squares. Thus, the calculation requires constant
time to evaluate.

How to run

The application can be run by executing the following command:

mix compile
mix run -e Starter <N> <k>

example:
mix run -e Starter 100000000 4

Testing

time mix run -e Starter 1000000 4 gives output as
Done (without any sequences being found)

with the execution times as

real   0m0.648s
user   0m1.107s
sys   0m0.140s

ratio = (1.107 + 0.140) / 0.648 = 1.92

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time mix run -e Starter 100000000 20 gives output as
62780852
88700958
Done

real   0m19.914s
user   1m11.588s
sys   0m0.237s

ratio = 3.6