Programming Assignment 2

1.2 99.9% parallelizable.

a) Max speedup: $\frac{1}{1-0.999} = \frac{1}{0.001} = 1000$

Sequential run-time: 300,000,000 seconds
Parallel run-time: 300,000 seconds.
Competitor run-time: 3 days = 259,200 seconds.

Unless our espionage team was almost a whole day off, there is no hope.

With a 150,000,000 second sequential run-time and thus a 150,000 second parallel run-time, we could beat the competitor

b) Consolidated version:

$$\frac{1}{(1-P)+(P/n)+(OV(n)/T_1)} \qquad OV(n) = 10n$$

For $T_1 = 300,000,000$ s: $\frac{1}{0.001 + 0.999/n + 10n/300,000,000}$

Max for $n > 0$ is 733.505
at $n = 300\sqrt{330} \approx 5449.77$
round to 5450

$300,000,000 / 733.505 =$ **408,995,413 seconds**
so no chance

For $T_1 = 150000000$
max for $n > 0$ is 660.585
at $n = 300\sqrt{165} \approx 3854$

$150,000,000 / 660.585 =$ **227,071.459 seconds**
this will beat the competitor
by 32,128,541 seconds

Hilroy

Programming Assignment 2

1.3 $0.01 per compute-hour
150,000,000 seconds

Theoretical max speed-up:

$$\max\left\{\frac{1}{0.001 + 0.99/n + 10n/150{,}000{,}000}\right\} = 660.585$$

i) Target speedup: 330.2925

cores to achieve this speedup is 497 (rounded up from 496.358)
Time: 150,000,000 / 330.2925 = 454,142.9188 seconds
= 126.151 hours
$(0.01 \times 126.151) \times 497 = \boxed{\$626.97}$

ii) Target speedup: 495.4388

cores to achieve this speedup is 1044 (rounded up from 1043.36)
Time: 150,000,000 / 495.4388 = 302,761.9125 seconds
= 84.101 hours
$(0.01 \times 84.101) \times 1044 = \boxed{\$878.01}$

Hilroy