

Algorithms Fall 2016 Homework 7 Solution

November 9, 2016

PROBLEM 1

Assume we need P processors. We have

$$T_1/P + T_\infty = T'_1/p + T'_\infty$$

$$\Rightarrow 2048/P + 1 = 1024/P + 8$$

$$\Rightarrow P \approx 146$$

PROBLEM 2

We can parallel the loops from line 5 - 7 in the procedure FLOYD-WARSHALL. The pseudocode is as follow:

P-FLOYD-WARSHALL(W)

```
1   $n = W.rows$ 
2   $D^{(0)} = W$ 
3  for  $k = 1$  to  $n$ 
4      let  $D^{(k)} = (d_{ij}^{(k)})$  be a new  $nn$  matrix
5      parallel for  $i = 1$  to  $n$ 
6          parallel for  $j = 1$  to  $n$ 
7               $d_{ij}^{(k)} = \min(d_{ij}^{(k-1)}, d_{ik}^{(k-1)} + d_{kj}^{(k-1)})$ 
8  return  $D^{(n)}$ 
```

The work is $T_1 = \Theta(n^3)$, total span is $T_\infty = \Theta(\lg n)$, the parallelism is $T_1/T_\infty = \Theta(n^2 \lg n)$