CS 231P: Parallel and Distributed Computing - Homework 9
Group 10

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1. J1: has 4 VPs
   J2: has 3 VPs
   J3: has 4 VPs
   J4: has 1 VPs
   J5: has 7 VPs
   J6: has 2 VPs

   Spatial Schedule for a distributed computing system with 5 physical processors, running a workload of 6 SMPD jobs:

6	Idle	Idle	Idle	Idle
6	5	5	5	5
2	4	5	5	5
2	3	3	3	3
1	1	1	1	2
PP1	PP2	PP3	PP4	PP5

   Temporal Schedule obtained from the above spatial schedule, with 0% idling ratio:

Time/ PE	PP1	PP2	PP3	PP4	PP5
1	1	1	1	1	2
2	2	3	3	3	3
3	2	4	5	5	5
4	6	5	5	5	5

5	6	3	3	3	3

For each of the 6 jobs, the progress of the VPs is strictly less than or equal to 1. This implies that for each job, no VP is ahead of the others for more than a single time slice. Therefore, the above temporal schedule is legal.

We can see from the above schedule, the total number of time slices = 5 and there are currently no Idle slots. Hence,
Idling Ratio = 0/25 = 0%

2. Processor 3 has failed
    a. New allocation on remaining 4 physical processors

New Spatial Schedule without Processor 3:

Idle	Idle	Idle	6
5	5	5	6
5	5	5	5
3	3	3	3
2	2	2	4
1	1	1	1
PP1	PP2	PP4	PP5

New Temporal Schedule, obtained from above spatial schedule:

Time/ PE	PP1	PP2	PP4	PP5
1	1	1	1	1
2	2	2	2	4
3	3	3	3	3
4	5	5	5	5
5	5	5	5	6
6	2	2	2	6

We can see from the above schedule, the total number of time slices = 6 and there are currently no Idle slots. Hence,
Idling Ratio = 0/24 = 0%

b. New allocation (spatial schedule) that uses the original 0% idling ratio as a basis and re-assigns the VPs originally allocated to Processor 3 among the other surviving processors.

Spatial Schedule obtained by reassigning VPs of Processor 3 :

Idle	Idle	Idle	5
6	1	3	5
6	5	5	5
2	4	5	5
2	3	3	3
1	1	1	2
PP1	PP2	PP4	PP5

Temporal Schedule obtained from the above Spatial Schedule:

Time/ PE	PP1	PP2	PP4	PP5
1	1	1	1	2
2	2	3	3	3
3	2	4	5	5
4	6	5	5	5
5	6	1	3	5
6	2	2	2	5

We can see from the above schedule, the total number of time slices = 6 and there are currently no Idle slots. Hence,
Idling Ratio = 0/24 = 0%

3. The cost in number of "migrating VPs" is calculated as one unit for every VP which is allocated to a new processor in the reassignment.

   The following table shows the processor on which the job is run on:

Jobs	Q.1 (Processor Number)	Option 1 - Q.2a (Processor Number)	Option 2 - Q.2b (Processor Number)
J1	1,2,3,4	1,2,4,5	1,2,4,2
J2	5,1,1	1,2,4	5,1,1
J3	2,3,4,5	1,2,4,5	2,4,5,4
J4	2	5	2
J5	3,3,4,4,5,5,2	1,1,2,2,3,3,4	2,4,4,5,5,5,5
J6	1,1	5,5	1,1

   From the above table, comparing processors allocated to each job in Question 1 and Question 2.a, the number of migrating VPs can be calculated as follows:

   1+2+1+1+4+2 = 11.

   Cost of migrating VPs = 11

   From the above table, comparing processors allocated to each job in Question 1 and Question 2.b, the number of migrating VPs can be calculated as follows:

   1+0+1+0+2+0 = 4

   Cost of migrating VPs = 4