SIT323 Practical Software Development, Trimester 2, 2019

Week 7 – Practical 6

Allocations

Introduction

Last week, during Task 7 of Practical 5, you were required to use a Greedy Algorithm, presented in Class 5, to determine an allocation of 15 tasks to 6 processors to consume a minimum amount of energy.

In that particular task, the overall duration of the program was not to exceed 10 seconds. An allocation based on that configuration is depicted in Table 1.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 1.

Task 1

That Greedy Algorithm appears to find an allocation very quickly, compared to examining 470,184,984,576 = 6^{15} combinations to find that allocation. However, this was dependent on the program duration of 10 seconds.

Using the configuration data of Task 7 (below), if the program duration was 100 seconds instead of 10 seconds, which processors would be used to allocate the 15 tasks to consume the minimum energy?

PROGRAM-MAXIMUM-DURATION	100
RUNTIME-REFERENCE-FREQUENCY	2
TASK-ID	RUNTIME
1	1
2	1
3	1
4	2
5	2
6	2
7	3
8	3
9	3
10	4
11	4
12	5
13	5
14	6
15	6
PROCESSOR-ID	FREQUENCY
1	1.5
2	1.8
3	2.3
4	2.7
5	3.3
6	3.9

Task 2

If the program duration was 60 seconds, confirm that the following allocation is valid.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Task 3

If the program duration was 30 seconds, confirm that the following allocation is valid.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Task 4

If the program duration was just 9 seconds, confirm that the following allocation is valid.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Task 5

If the program duration was just 7 seconds, confirm that the following allocation is valid.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
3	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Task 6

What is an allocation for a program duration was just 6.6667 seconds?

Task 7

Determine an allocation using the following table of runtime data, a program duration of 30 seconds, and the heuristic that deletes the largest values first,

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.3	2.7	5.3	5.3	8.0	9.3	12.0	12.0	14.7	16.0	18.7	20.0	28.0	28.0	30.7
2	1.1	2.2	4.4	4.4	6.7	7.8	10.0	10.0	12.2	13.3	15.6	16.7	23.3	23.3	25.6
3	0.9	1.7	3.5	3.5	5.2	6.1	7.8	7.8	9.6	10.4	12.2	13.0	18.3	18.3	20.0
4	0.7	1.5	3.0	3.0	4.4	5.2	6.7	6.7	8.1	8.9	10.4	11.1	15.6	15.6	17.0
5	0.6	1.2	2.4	2.4	3.6	4.2	5.5	5.5	6.7	7.3	8.5	9.1	12.7	12.7	13.9
6	0.5	1.0	2.1	2.1	3.1	3.6	4.6	4.6	5.6	6.2	7.2	7.7	10.8	10.8	11.8