2020/2021 Second Semester

Course Code	DS630
Course Name	Artificial Intelligence for Data Science
CRN	24543
Assignment type	Critical Thinking
Module	04
Assignment Points	125

Student ID	G200007615
Student Name	Abdulaziz Alqumayzi

Critical Thinking Assignment 2

Introduction

In this activity, critical thinking assignment 2; we will define building a product which is a PC, mentioning the main components of that PC we are building, and each component has assigned to a task number plus duration in hours. Also, in this activity, we will define talk about two constraints which are precedence and disjunctive constraints. Then lastly, we will provide a conclusion for this critical thinking assignment 2.

Define PC Components

The PC that we will assemble has nine main components that will be shown in (Table 1) below. We have a computer case as a task number 1 and a duration time of 1 hour; power supply as a task number 2 and a duration time of 2 hours; motherboard is task number 3 and has duration time of 4 hours; CPU processor is the task number 4 and has duration time of 2 hours; CPUs air cooler is the task number 5 and has a duration time of 3 hours; the video graphic device is the task number 6 and has a duration rime of 1 hour; next component is RAM memory which is the task number 7 and has a duration time of 1 hour; the next two components are hard drive and optical drive are the tasks 8 and 9 respectively and both has a duration time of 2 hours. The total number to build that PC is 18 hours, or 2 days and 2 hours if we consider that the assembler guy works only 8 hours per day.

College of Computing and Informatics

Table 1

PC components, tasks number, and tasks duration time.

Main components	Task Number	Tasks Duration Time (hours)
Computer Case	1	1
Power Supply	2	2
Motherboard	3	4
CPU Processor	4	2
CPUs Air Cooler	5	3
Video Graphic Device	6	1
RAM Memory	7	1
Hard Drive	8	2
Optical Drive	9	2

Define Constraint Satisfaction Problems

Constraint satisfaction problem (CSP) has three main components, which are X for the set of variables, D for the set of domains, one for each variable, and C for the constraints to permit combinations of values. In our example, X is the set of main components such as computer case, motherboard, and Ram memory. D is the set of domains which is tasks duration time. Lastly, C is the constraints that we will define is later, which are precedence constraints and disjunctive constraints to our job-shop scheduling.

Let us assume that we want to build a PC and we want to decrease the duration time to build that PC. But there are constraints we have to be aware of, for example, building

components of the PC have a flow; some parts cannot be built together, and some parts must be a pre-parts assembly for other parts and so on. To clarify, RAM memory is post-part for the motherboard, in contrast, the computer case is pre-part for the motherboard.

Now let us talk about the two constraints mentioned before precedence and disjunctive constraints. Precedence constraint is one task that must occur before another and disjunctive constraint is the amount of required time to complete a task and that task cannot overlap another task. Our precedence constraints between tasks are T1 + d1 <= T2

In our example, computer case must be placed before install the power supply and takes 1 hour, so we can write the following precedence:

Computer Case + 1 <= Power Supply

The next task can be a combination of flow tasks that comes in one process. CPUs air cooler is a post-part for CPU processor and motherboard is a pre-part of the CPU processor, so we can combine this task in one flow as the following precedence:

Motherboard + 4 <= CPU Processor **AND** CPU Processor + 2 <= CPUs Air Cooler

Now let us talk about disjunctive constraints, suppose that only one assembler guy will build this PC, the assembler guy cannot do the precious tasks simultaneously; he can only do one task of the previous tasks. The disjunctive constraints will be as the follow:

(Computer Case + 1 <= Power Supply) **OR** (Motherboard + 4 <= CPU Processor AND CPU Processor + 2 <= CPUs Air Cooler)

Final PC Product Tasks

Another thing to mention is that the tasks of building the PC can be combined as one task to decrease the duration of the time building that PC. For example, instead of installing

the PC's motherboard, CPU processor, and CPUs air cooler, you can be purchasing them built up and ready to use and assemble with other parts. The following (Table 2) shows us the decrease in duration time and tasks when we purchase built-up parts.

Table 2

PC components, tasks number, and tasks duration time.

Main components	Task Number	Tasks Duration Time (hours)
Computer Case with Power Supply	1	1
Motherboard with CPU Processor and CPUs Air Cooler	2	1
Video Graphic Device	3	0.5
RAM Memory	4	0.5
Hard Drive	5	1
Optical Drive	6	0.5
Quality Assurance	7	1

We can see from the final product table that the duration became 5 hours and 30 minutes instead of 18 hours that took 2 days of assembling the PC including a new task which is the quality assurance that takes one-hour duration to ensure the quality of assembling the PC are good.

References

Russell, S. J., & Norvig, P. (2021). *Artificial intelligence: A modern approach*. Hoboken: Pearson.