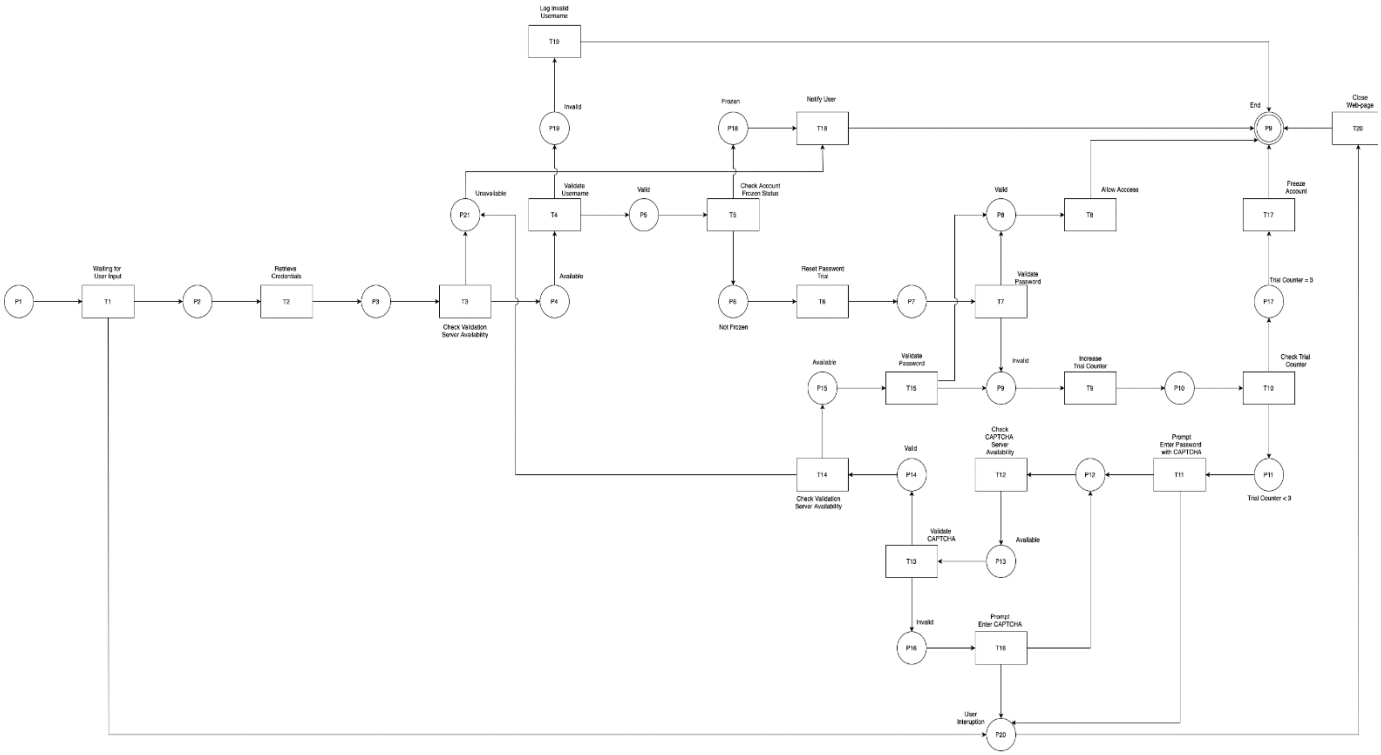
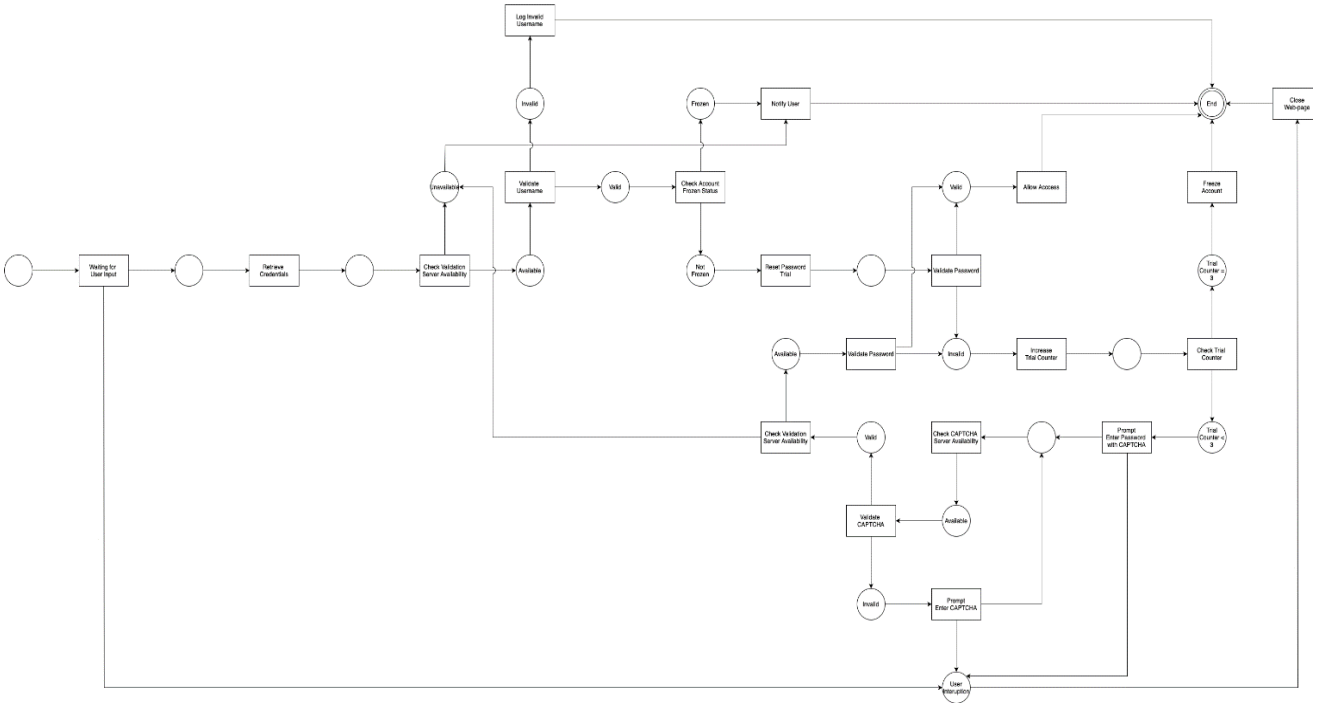
PROCESS MODELLING WITH PETRI NETS

Modelling Information Systems

TASK 1

Petri Net Diagram





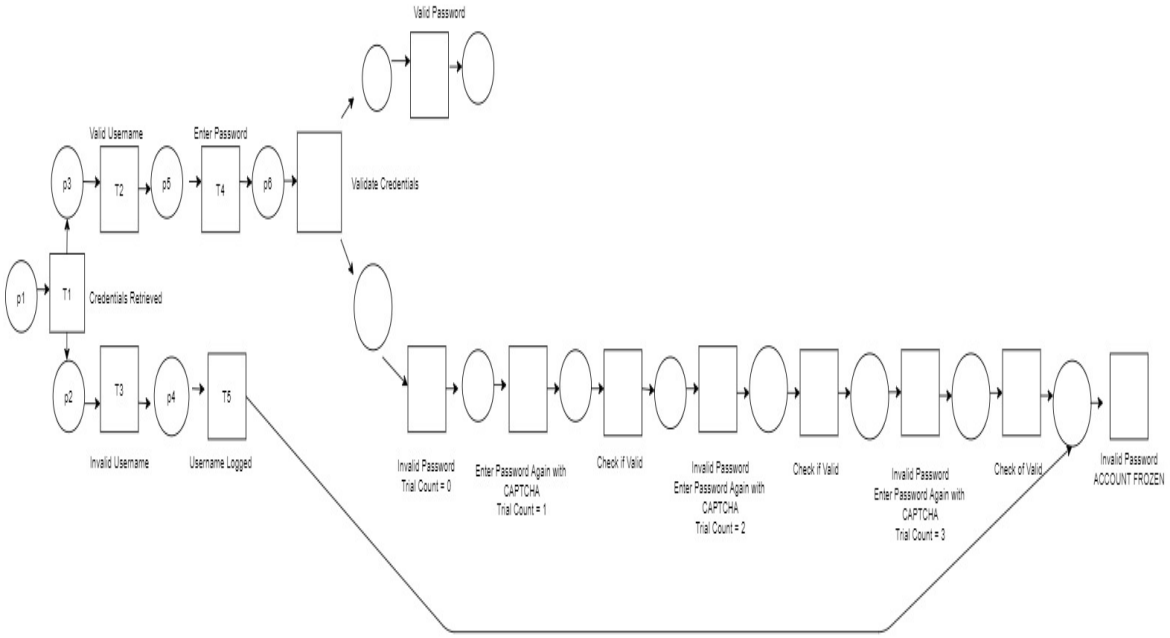
TASK 2

Bottle Necks

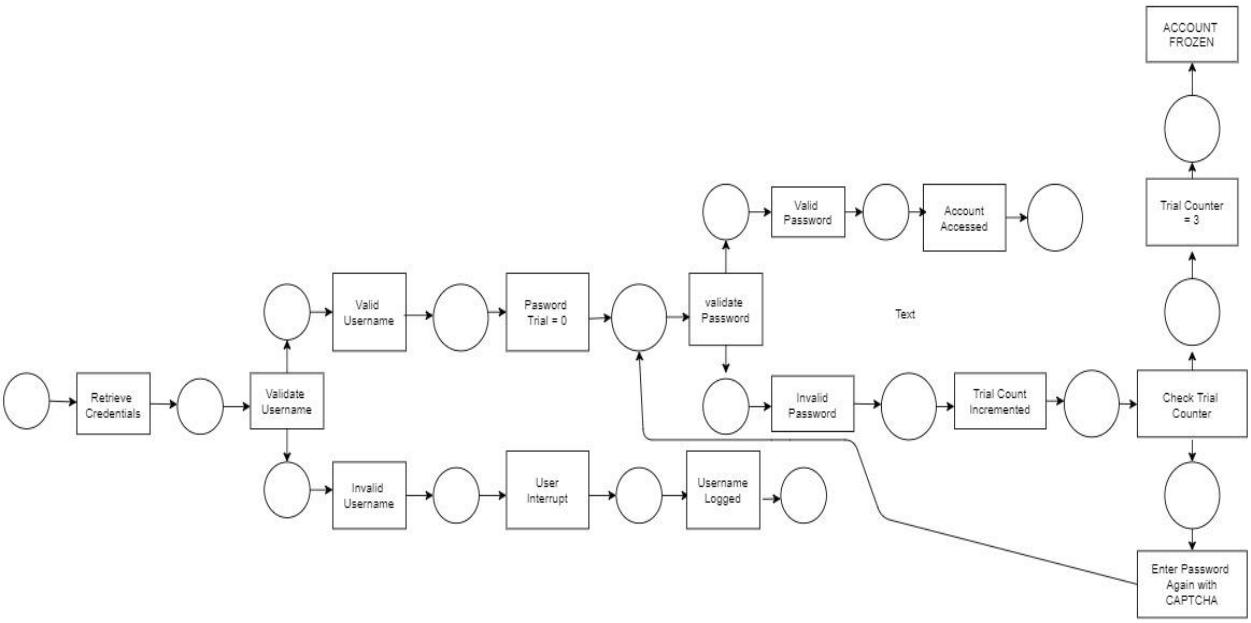
There were no bottlenecks observed in our Petri Net Diagram.

Improvements

Firstly, the simplification of the step-by-step procedure of the task. The group initially decided to lay down a very detailed procedure on how the process will be achieved without any information or any single process loss. Unfortunately, after trying out the first decision the group ended up a very long and messy Petri Net Diagram to which resulted to information that are not necessary anymore for the process. The group then decided to group cut down several unwanted places and group the "re-enter password with CAPTCHA" into 1 transition instead of 3 to minimize the diagram. In addition, the group decided to only include transitions that are mentioned and necessary.



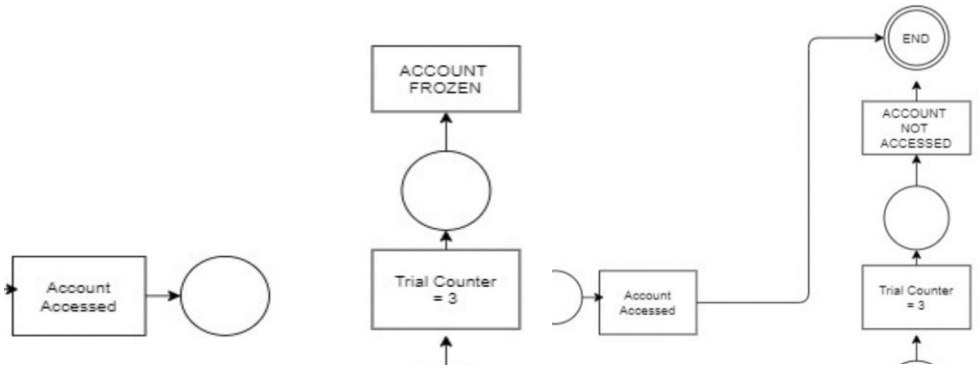
Petri Net draft (Version 1).



Petru Net Draft (version 2)

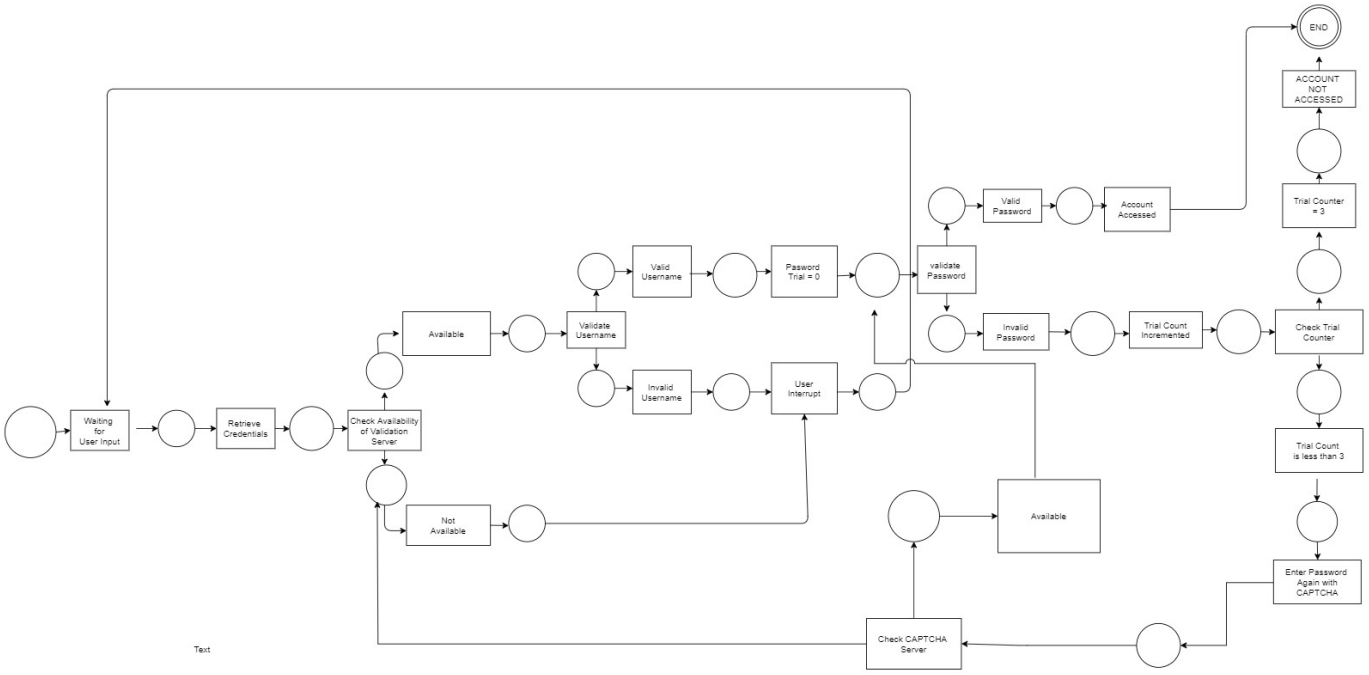
Secondly, after going through the simplification process of version 1, another problem encountered was there was too many hanging places within the body of the diagram. We were told that there should only be one initial place and one final place. One example that the group used for this case was, we noticed that the transitions named ‘account accessed’ and ‘account frozen’ were hanging so we decided to connect it to one final place.

Version 2 version 3

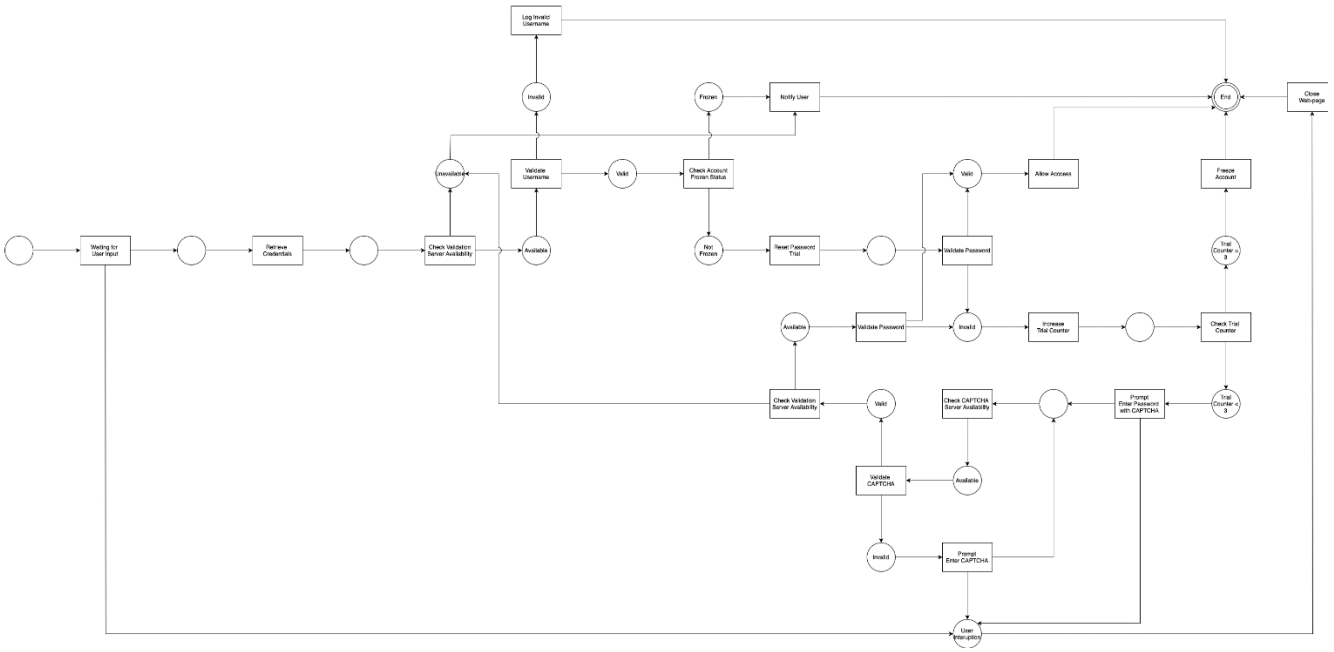


Finally, the addition of possible network assumptions. This was a challenge for the group due to an additional assumption made or to be added to the diagram might ruin the majority of the flow in the system which leads to adjustments and re-placing transitions and places. We also assume that the validation of CAPTCHA is independent to the validation of password as

both CAPTCHA server and validation server are independent. This mean that failure to pass CAPTCHA validation will not increase the password trial counter, the user is instead prompted to enter the CAPTCHA again until it is correct. The process of validating password will take place after confirming that CAPTCHA is corrected.



Petri Net draft (version 3)



Petri Net draft (Final Version)

Assumptions

It is assumed that there will be a status check for the frozen status of the account which will be carried out after confirmed that the username is valid. In case of unfrozen account, the system will process to reset the password trial counter per scan.

In case of frozen account, the user will be notified of their account status before ending the process. In addition, we also assume that the validation of CAPTCHA is independent to the validation of password as both CAPTCHA server and validation server are independent. This mean that failure to pass CAPTCHA validation will not increase the password trial counter, the user is instead prompted to enter the CAPTCHA again until it is correct. The process of validating password will take place after confirm that CAPTCHA is corrected.

Subsystems

There are 2 subsystems identified in this scenario. First is the validation server which is responsible for the validation of username and password. Another subsystem is the CAPTCHA server which responsible for validating CAPTCHA when the user enter password from the second time onward. Both subsystem can be unavailable which will result in the disruption of the routine.

Difficulties

During the process of building our Petri Net there were some difficulties encountered such as having to make a final decision and model of our petri net and the addition of assumptions.

Initially, each member of the group had drawn and provided their own petri net draft. This arose complication on how each ideas of each member should be taken in consideration to achieve one final output. Each had a different opinion and visualization on how the petri net should look like. To solve this problem, we have agreed to work on the drafts one by one, this means one person should work on a first draft and that initial draft should be sent to another team member for it to be improved, this is how we arrived from our First version to our Version 3. Once this was done, another difficulty encountered was the addition of assumptions within the petri net. Since each of us had our own different ideas once again we have agreed to draw each of the assumption that we have thought of and incorporate these ideas in the entire diagram, each changes made and additions added were carefully discussed before adding it to the final diagram.

Furthermore, a difficulty that we have encountered associated with the petri net diagram is when the tendency of creating a deadlock when modelling a loop process can easily be overlooked due to the separation of transitions and places. Modelling of a conditional situation increase the complexity of the Petri net, all the more so if loops is involved.

Advantages

According to Barenji, Ozkaya, Barenji (2017), Manufacturers and Designers of a system should take in consideration the possible changes and innovations that might occur between the development process of a system for a business to continue and remain competent in the market. However, making changes in a system without the proper planning could potentially cause a high risk of financial disruption for an institution. Due to this, a production system should be designed in a very detailed approach and have a careful planning. In addition, it is said that an effective, cost-efficient, and safe approach before implementing and building a proposed system is to conduct proper modelling, research, and analyzation processes in order to predict possible system failure and behaviours. Using such methods before disrupting and changing current system process helps designers make sound decision on whether the system will be in need of drastic change. Furthermore, the use of Petri in designing a system helps the manufacturers or system designers visualize the step-by-step process of the entire system. This helps system designers determine whether there are possible deadlocks or system overflows and makes it easier for the designers to make changes and insert new implementation where necessary, allowing the system to be tested first before making final changes in the system that is currently operating minimizes financial loss and system failures. Moreover, according to Choi (1994), having a detailed structure and with the use of various techniques for system analysis determines the completeness of a petri net system. Furthermore, Petri nets mays be used in a wide variety of system modelling due to its simplicity and reachability. This allows system designers and other people involved to make sound decisions due to reachability problems are decidable almost all problems may be converted to reachability problems.

Disadvantages

Petri Nets make an important influence in those information systems which includes these aspects: concurrency or parallelism, Asynchronous and synchronous, Deadlock, Conflict,

Event driven, Real-time control and Mathematical foundation. However, Petri Nets also have some disadvantages. First of all, the concurrence of operations is more common. Because it improves utilization and throughout, which make operations more complicated (Choi, 1994). Moreover, Petri Nets do not have the ability to model various kind of systems. Its subclass can increase the power of decision. However, most analysis questions cannot be decided in most known cases. Finally, Petri net models cannot test specific marking in a unbounded place and get result of the test.

References:

Barenji, R.V., Ozkaya, B.Y., Barenji, A.V.(2017). Quantifying the Advantage of Kitting System Using Petri Nets: a case study in Turkey, modelling, analysis, and insights. *The international journal of Advanced Manufacturing Technology. 93, 3677-3691. Doi:* https://doi.org/10.1007/s00170-017-0430-y.

Choi, B.W. (1994*). Petri Nets approaches for modelling, controlling and validating flexible manufacturing systems*. (Unpublished Thesis Dessertations). Iowa State University, United States.

DECLARATION AND STATEMENT OF CONTRIBUTION FORM

Assignment Title/No: Process Modelling with Petri Nets

How many people worked on this assignment? _3_

FULL NAME	**STUDENT NUMBER**	**Description of responsibilities. State which sections (numbered) for which you were responsible, and/or state other clearly responsibilities**	**% CONTRIBUTION**	**Was responsibility (including plagiarism check) carried out (Y/N)? Explain.**	**SIGNATURE**
LANXI LI	**N10362428**	Contributed in the construction of the overall model of Petri Nets and introduced possible Assumptions. Moreover, provided opinions and information for task 2.	**33.33%**	Yes. She provided references regarding the disadvantage of a petri net diagram. In addition, opinions, discussions, and improvements were based on her own knowledge.	**APPROVED (Lanxi Lee)**

RONA ROSAL	**N10360387**	Contributed in the construction of the overall model of Petri Nets and introduced possible Assumptions. Moreover, provided opinions and information for task 2.	**33.33%**	Yes. She provided references regarding the advantages of a petri net diagram. In addition, opinions, discussions , and improvements were based on her own knowledge.	**APPROVED (Rona Rosal)**
TUNG HOANG	**N10094865**	Contributed in the construction of the overall model of Petri Nets and introduced possible Assumptions. Moreover, provided opinions and information for task 2.	**33.33%**	Yes. The explanation for the added assumptions, opinions, and discussions given were based on his own knowledge	**APPROVED (Tung Hoang)**