CSCI803 Project

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1 Part 1

1.1 1)

$$P' = \{p_1, p_2, p_3, c_1, c_2, p_4, p_5, p_6\}$$

$$^{\circ}P' = \{t_1, t_2, t_3, t_4, t_5, t_6\}$$

$$P'^{\circ} = \{t_1, t_2, t_3, t_4, t_5, t_6\}$$

A trap is a set of places P such that the set of output transitions of P is included in the set of input transitions of P.

We have $P'^{\circ} \subseteq {}^{\circ}P'$.

A siphon is a set of places P such that the set of input transitions of P is included in the set of output transitions of P.

We have ${}^{\circ}P' \subseteq P'^{\circ}$.

Based on these, traps and siphons exist in the given Petri net.

1.2 2)

We suppose the marking of p_2 have passed to p_1 , and the marking of p_4 have passed to p_5 . And we use the fundamental equation to prove the features.

$$M_0 = (1, 0, 0, 0, 1, 0, 1, 1)$$

$$s_0 = (0, 1, 0, 0, 0, 0)$$

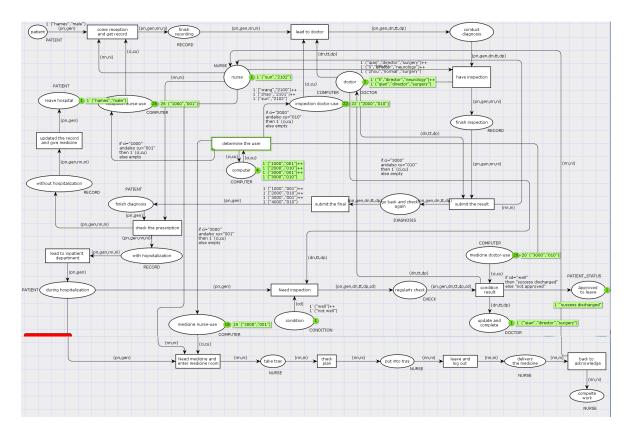
$$W = \begin{bmatrix} 1 & -1 & 0 & 0 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 & 0 \\ 0 & 1 & -1 & 0 & 0 & 0 \\ 0 & 0 & 0 & -1 & 0 & 1 \\ 0 & 0 & 0 & 1 & -1 & 0 \\ 0 & 0 & 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 0 & -1 & 1 \\ 0 & -1 & 1 & 0 & 0 & 0 \end{bmatrix}$$

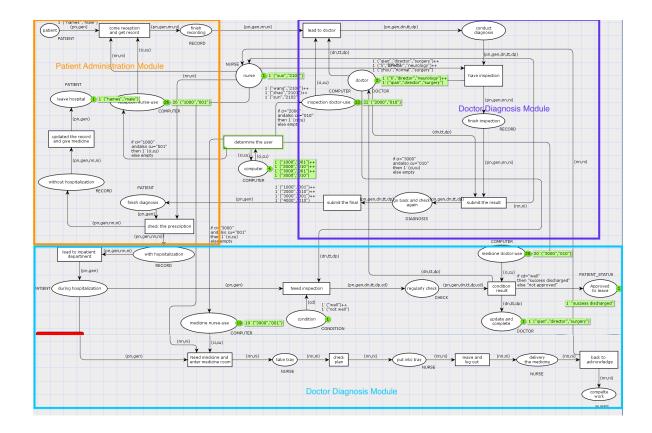
$$M_0 + W \cdot s_0 = M$$

 $M = (0, 0, 1, 0, 1, 0, 1, 0)$

We can see after fundamental equation, p_3, p_5, c_1 have the marking, and because c_2 don't have the marking, so p_6 won't have the marking. Based on the analysis, p_3 and p_6 cannot contain one token at the same time for all reachable markings M, e mutual exclusion feature of the Petri net model is proved.

2 Part 2





- 1. Set of places: P={patient, nurse, computer, reception nurse-use, finish recording, finish diagnosis, without hospitaliztion, doctor, inspection doctor-use, conduct diagnosis, finish inspection, go back and check again, with hospitaliztion, during hospitaliztion, medicine nurse-use, take tray, put int tray, delivery the medicine, complete work, regularly check, update and complet, approved to leave, medicine doctor-use, condition}
- 2. Set of transitions: T={come reception and get record, determine the user, check the prescription, updated the record and give medicine, lead to doctor, have inspection, submit the result, submit the final, lead to inpatient department, need inspection, condition result, need medicine and enter medicine room, check plan, leave and log out, back to acknowledge}
- 3. Set of arcs: $A=\{(patient, come\ reception\ and\ get\ record),\ (come\ reception\ and\ get\ record, finish\ recording),\ (reception\ nurse-use,\ come\ reception\ and\ get\ record),\ (nurse,\ come\ reception\ and\ get\ record),\ (finish\ recording,\ lead\ to\ doctor),\ (inspection\ doctor-use,\ lead\ to\ doctor),\ (doctor,\ lead\ to\ doctor),\ (lead\ to\ doctor,\ conduct\ diagnosis),\ (conduct,\ have\ inspection),\ \cdots,\ (back\ to\ acknowledgek,\ complete\ work)\}$
- 4. Set of colour sets: $\Sigma = \{\text{PATIENT, RECORD, NURSE, COMPUTER, DOCTOR, DIAGNOSIS, CONDITION, PATIENT_STATUS}\}$
- 5. Set of variables: V={pn:PATIENT_NAME, gen:GENDER, ni:NURSE_ID, nn:NURSE_NAME, ci:COMPUTER_ID, cu:COMPUTER_USER, dn:DOCTOR_NAME, tt:TITLE, dp:DEPARTMENT, cd:CONDITION}

6. Set of colour set functions:

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PATIENT if p \in \{PATIENT \ NAME, GENDER\}
C(p) = \begin{cases} NURSE & \text{if } p \in \{NURSE\_NAME, NURSE\_IE\} \\ COMPUTER & \text{if } p \in \{COMPUTER\_ID, COMPUTER\_USER\} \\ DOCTOR & \text{if } p \in \{DOCTOR\_NAME, TITLE, DEPARTMENT\} \\ DIAGNOSIS & \text{if } p \in \{PATIENT\_NAME, GENDER, DOCTOR\_NAME, TITLE, DEPARTMENT\} \\ CONDITION & \text{if } p = CONDITION \\ PATIENT\_STATUS & \text{if } p = PATIENT\_STATUS \end{cases}
                                            NURSE \quad \text{if } p \in \{NURSE\_NAME, NURSE\_ID\}
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7. Set of arc expression functions:

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1'(pg, gen)
                                                                                if a \in \{(\text{patient, come reception and get record}), \cdots \}
E(a) = \begin{cases} 1'(nn, ni) \\ 1'(ci, cu) \\ if ci = "1000" \\ and also <math>cu = "001" \\ then 1'(ci, cu) \\ else empty \\ if ci = "2000" \\ and also <math>cu = "010" \\ then 1'(ci, cu) \\ else empty \\ if ci = "3000" \\ and also <math>cu = "001" \\ then 1'(ci, cu) \\ else empty \\ if ci = "3000" \\ and also <math>cu = "010" \\ then 1'(ci, cu) \\ else empty \\ if ci = "3000" \\ and also <math>cu = "010" \\ then 1'(ci, cu) \\ else empty \\ 1'(dn, tt, dp) \\ 1'(cd) \end{cases}
                                                    1'(nn, ni)
                                                                               if a \in \{(\text{nurse,come reception and get record}), \dots \}
                                                                                if a \in \{(\text{computer, determine the user}), \dots \}
                                                                                if a = (determine the use, reception nurse-use)
                                                                                if a = (determine the use, inspection doctor-use)
                                                                                if a = (determine the use, medicine nurse-use)
                                                                                if a = (determine the use, medicine doctor-use)
                                                                                if a \in \{(\text{doctor}, \text{lead to doctor}), \dots\}
                                                            1'(cd)
                                                                                if a = (condition, need inspection)
                                             if cd = "well"
                       then "success discharged"
                                  else "not approved"
                                                                                if a = (condition result, approved to leave)
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8. Set of initialisation functions

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All Patient if p = patient
I(p) = \begin{cases} AllNurse & \text{if } p = nurse \\ AllDoctor & \text{if } p = doctor \\ AllComputer & \text{if } p = computer \\ 1'("1000", "001") & \text{if } p = reception \ nurse - use \\ 1'("2000", "010") & \text{if } p = inspection \ doctor - use \\ 1'("3000", "001") & \text{if } p = medicine \ nurse - use \\ 1'("3000", "010") & \text{if } p = medicine \ doctor - use \\ 1'" & \text{if } p = approved to leave \\ 1'("well") \ \text{and } 1'("notwell") & \text{if } p = condition \end{cases}
                                                                                                                              AllNurse if p = nurse
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3 Part 3

