

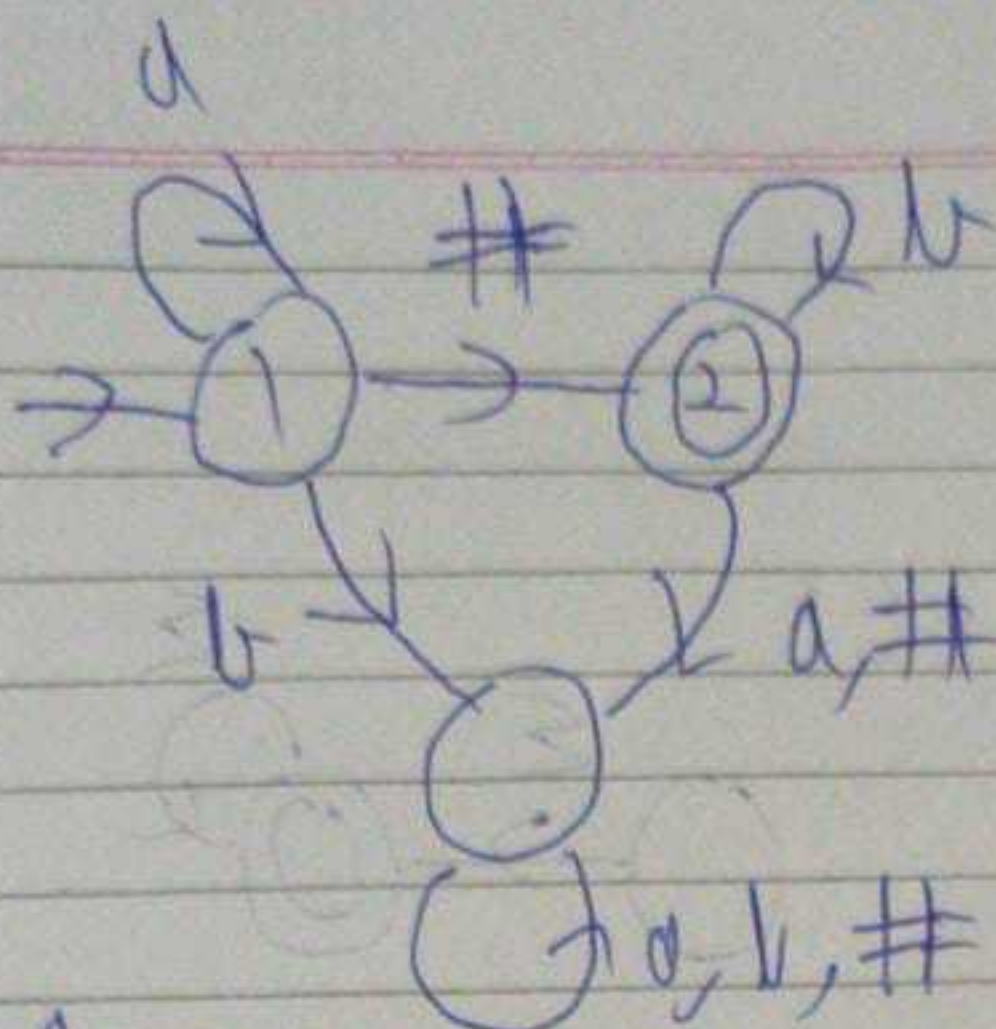
$$\exists x, y [ \text{First}(x) \wedge \text{Last}(y) \wedge [ [ \theta_a(x) \wedge \theta_a(y) ]$$

$$\wedge [ \theta_b(x) \wedge \theta_b(y) ] ] ]$$



1.  $a^*$ 2.  $a^* \# b^*$ 

b)

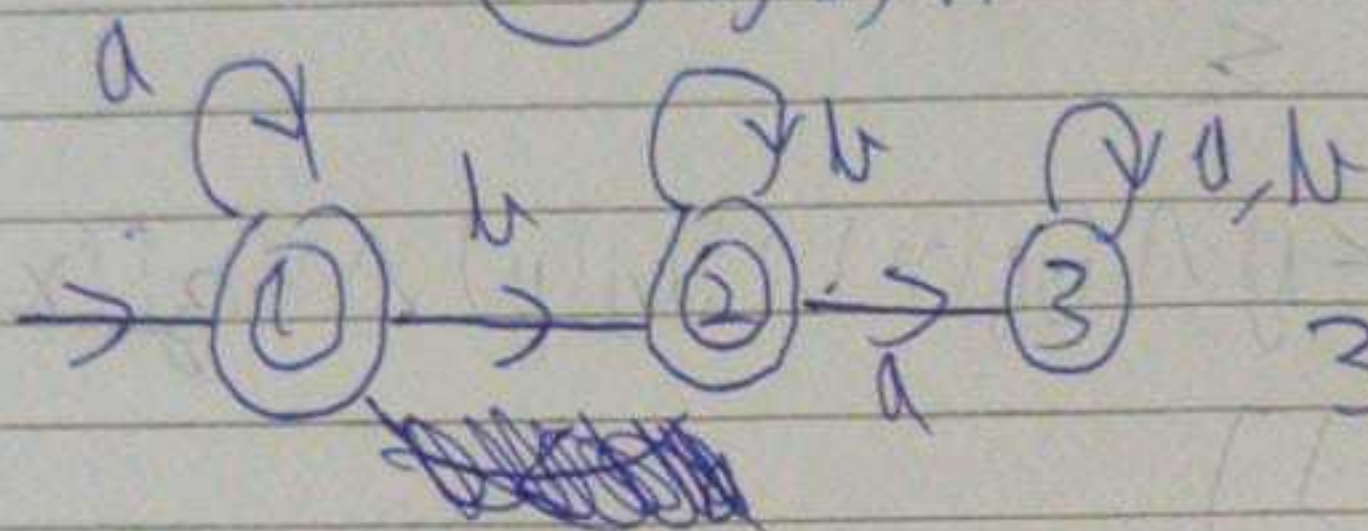


$$\exists x [\theta_H(x) \wedge \forall y$$

$$[(x < y \rightarrow \theta_H(y))$$

$$\wedge (y < x \rightarrow \theta_a(y))]$$

c)



$$1. a^* \\ 2. a^* b^* a^* \\ 3. a^* b^* a^* \leq^*$$

$$\forall n, y [( \theta_H(n) \wedge S(n, y) ) \rightarrow \neg \theta_a(y)]$$

$$1) \text{ Second}(n) := \exists y (\forall z (\neg (z < y)) \wedge S(y, x))$$

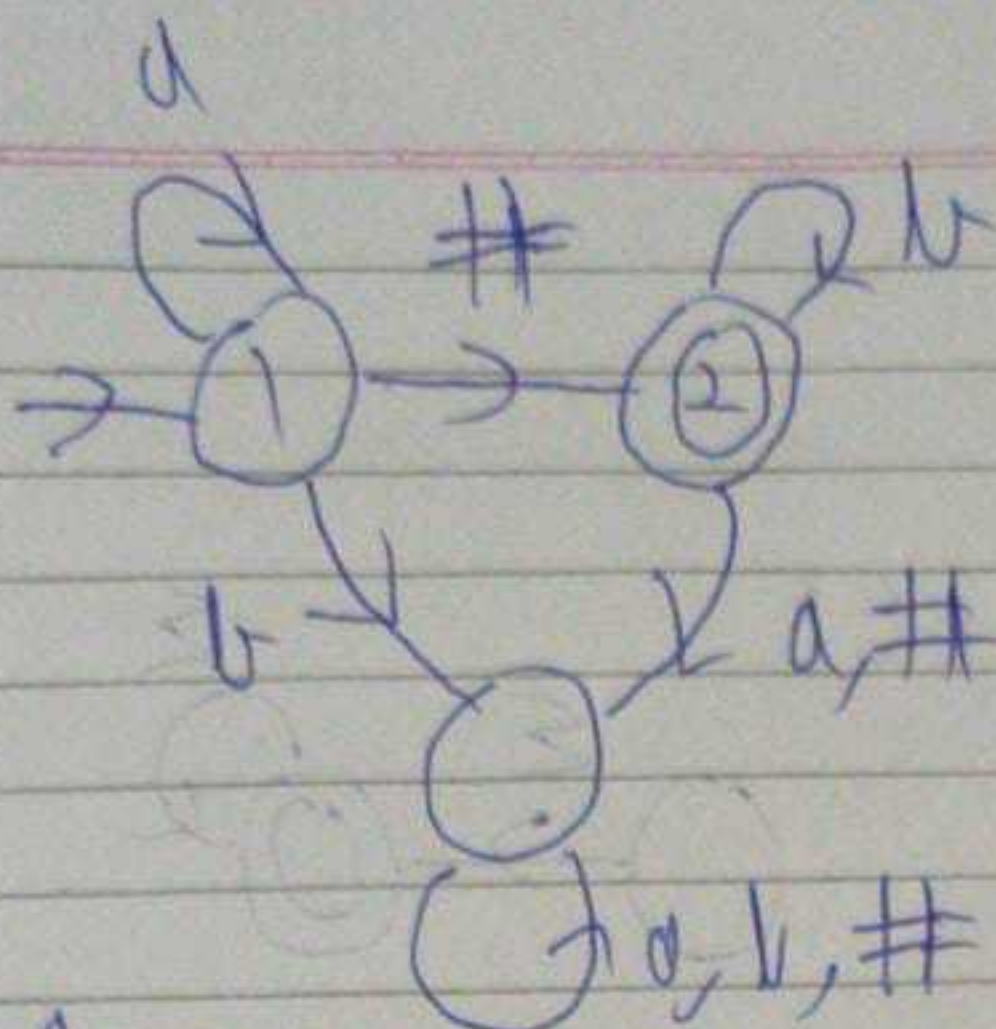
$$\text{SecondLast}(n) \quad \exists y [\forall z (\neg (y < z)) \wedge S(x, y)]$$

$$\exists x, y [\text{Second}(x) \wedge \theta_0(n) \wedge \text{Second}_{\text{Last}}(y) \wedge \theta_0(y)]$$



1.  $a^*$ 2.  $a^* \# b^*$ 

b)

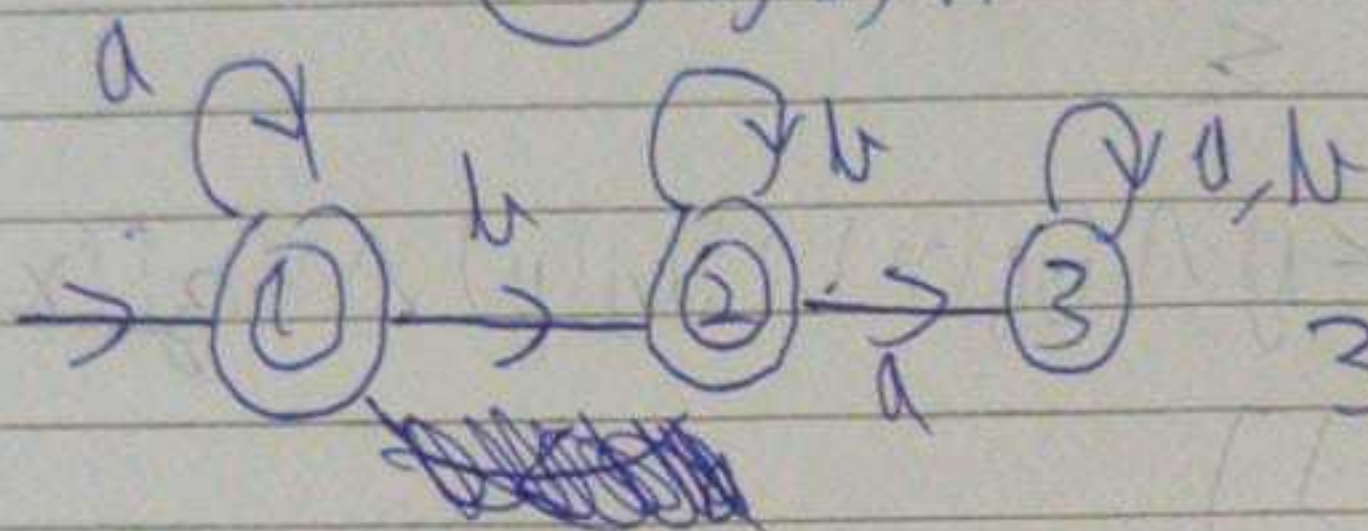


$$\exists x [\theta_H(x) \wedge \forall y$$

$$[(x < y \rightarrow \theta_H(y))$$

$$\wedge (y < x \rightarrow \theta_a(y))]$$

c)



$$1. a^* \\ 2. a^* b^* a^* \\ 3. a^* b^* a^* \Sigma^*$$

$$\forall n, y [( \theta_H(n) \wedge S(n, y) ) \rightarrow \neg \theta_a(y)]$$

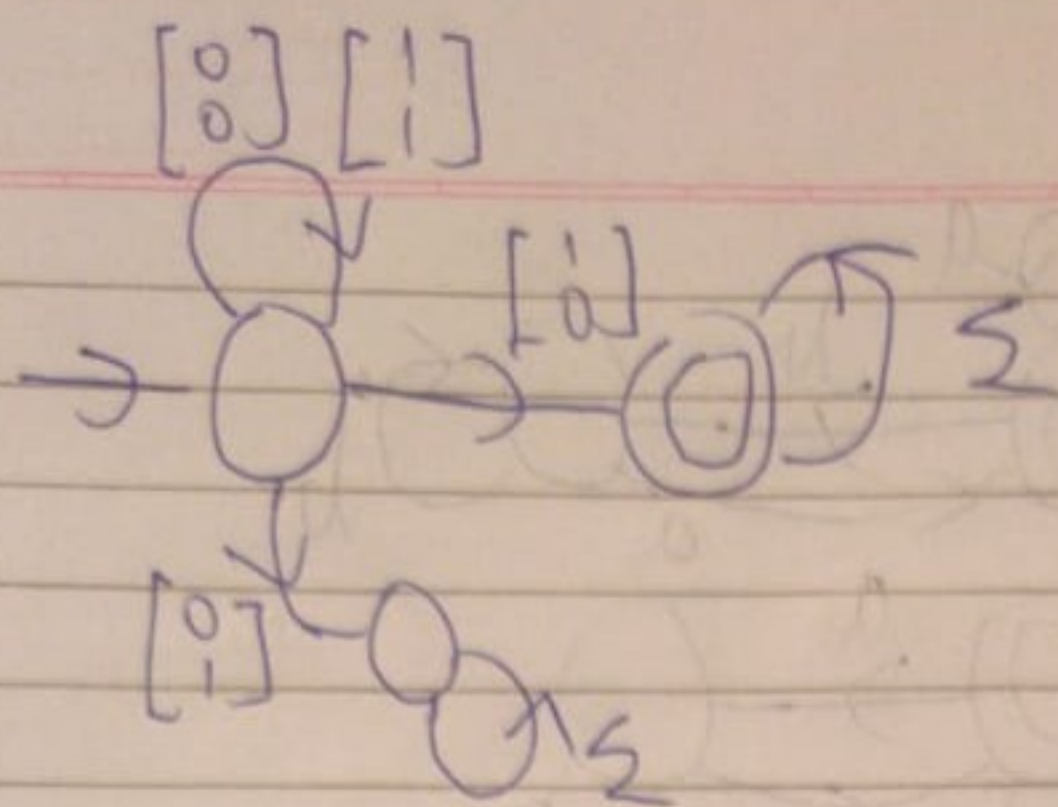
$$1) \text{ Second}(n) := \exists y (\forall z (\neg (z < y)) \wedge S(y, x))$$

$$\text{SecondLast}(n) \quad \exists y [\forall z (\neg (y < z)) \wedge S(x, y)]$$

$$\exists x, y [\text{Second}(x) \wedge \theta_0(n) \wedge \text{Second}_{\text{Last}}(y) \wedge \theta_0(y)]$$

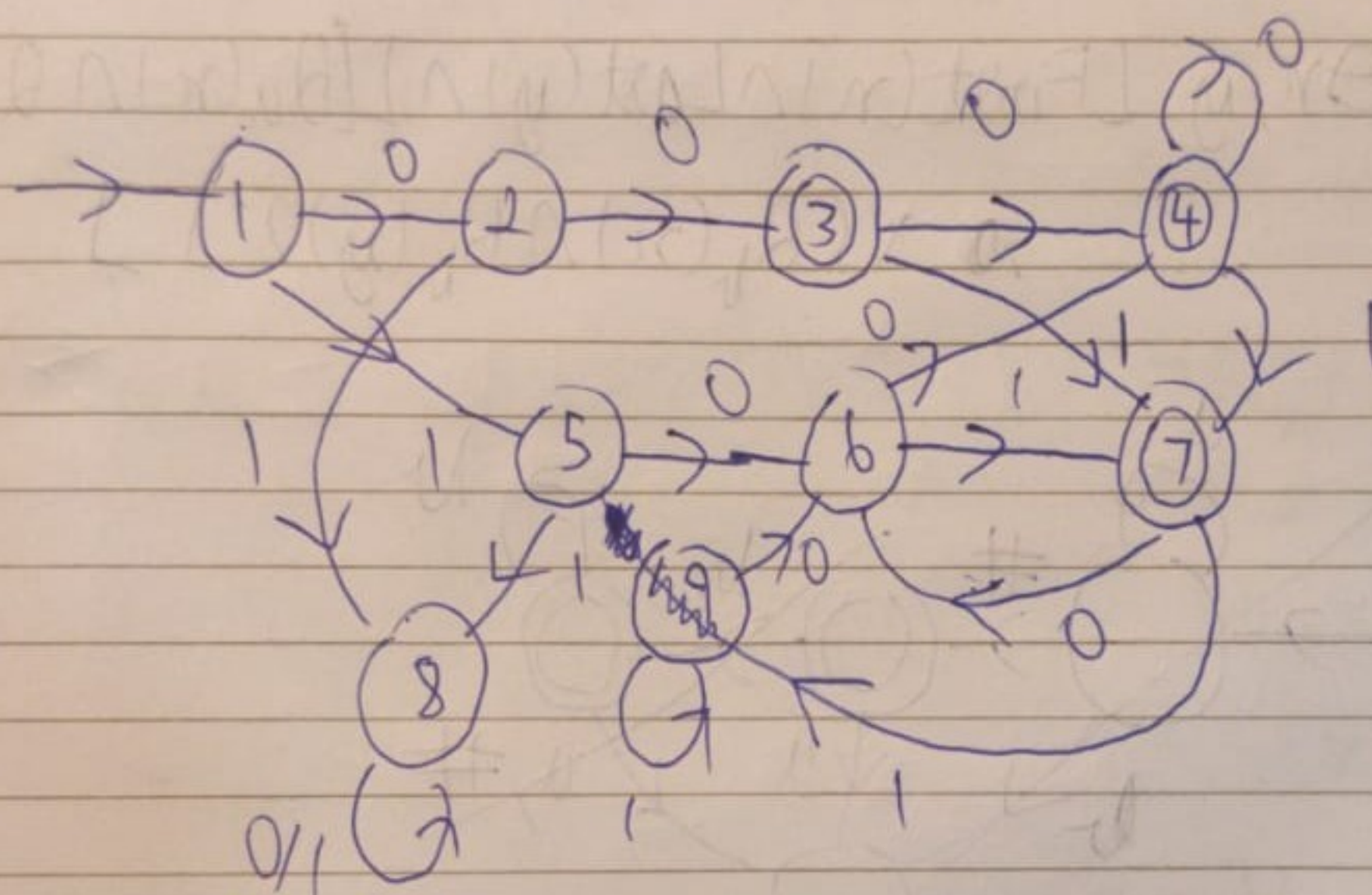


2)



$$\exists x (Q_1(x) \wedge \forall y [y < x \rightarrow \neg Q_1(y)])$$

3)



- |                        |                   |
|------------------------|-------------------|
| 8. Second symbol not a | 3. 00 → accepting |
| 1. Initial             | 6. Last two 10    |
| 2. 0                   | 9. Last two 11    |
| 5. 1                   | 4. Last two 00    |
|                        | 7. Last two 01    |

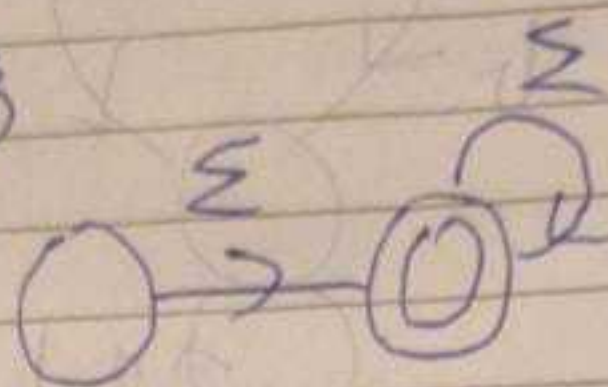
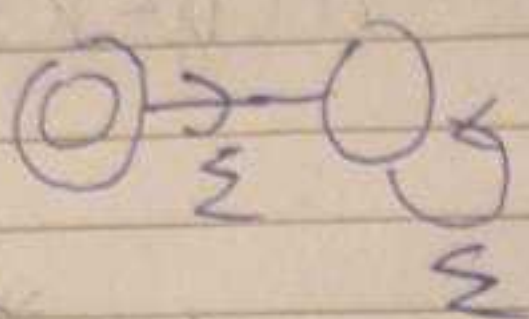
3, 4, 6, 7, 9 only if the second symbol is 0



2

~~$\forall x (x \neq x)$~~   
 $\forall x (x \neq x)$

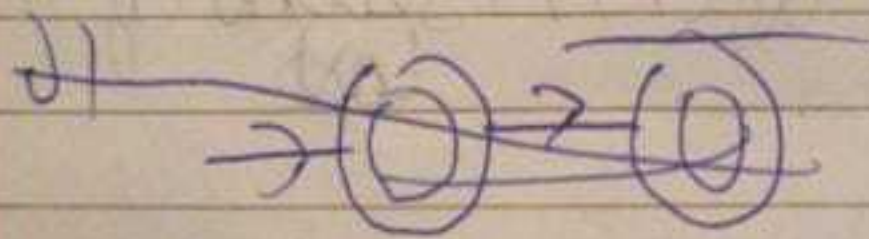
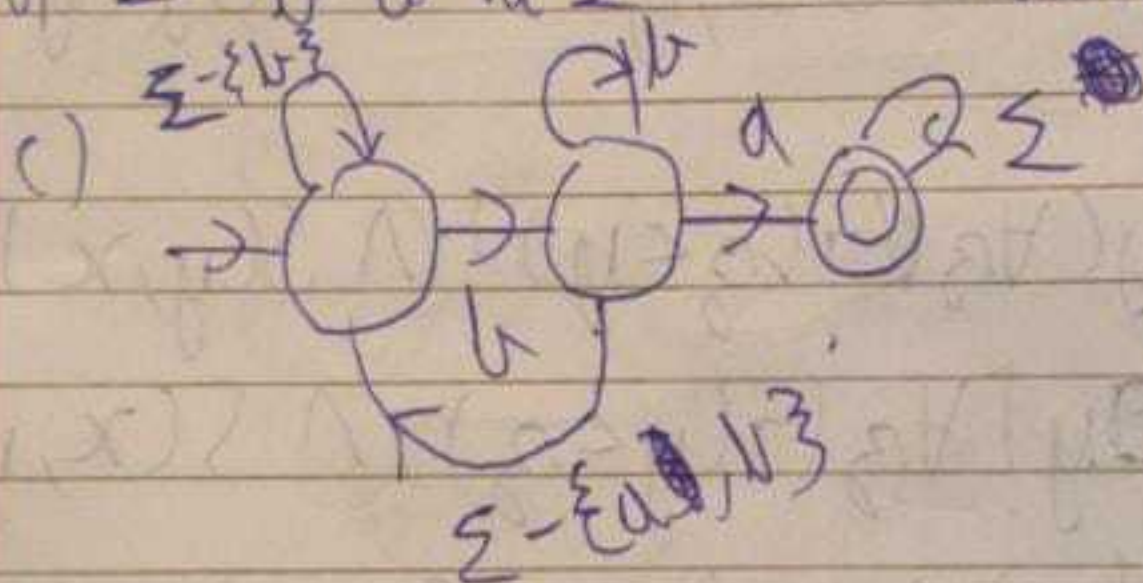
1)  $\Sigma = \{ \}$ , 2)  $\Sigma^* = \{ \epsilon \}$



2.  $\exists x \exists y [x < y \vee (\theta_1(x) \wedge \theta_2(y) \wedge \forall z [(x < z < y) \rightarrow \theta_3(z)])]$

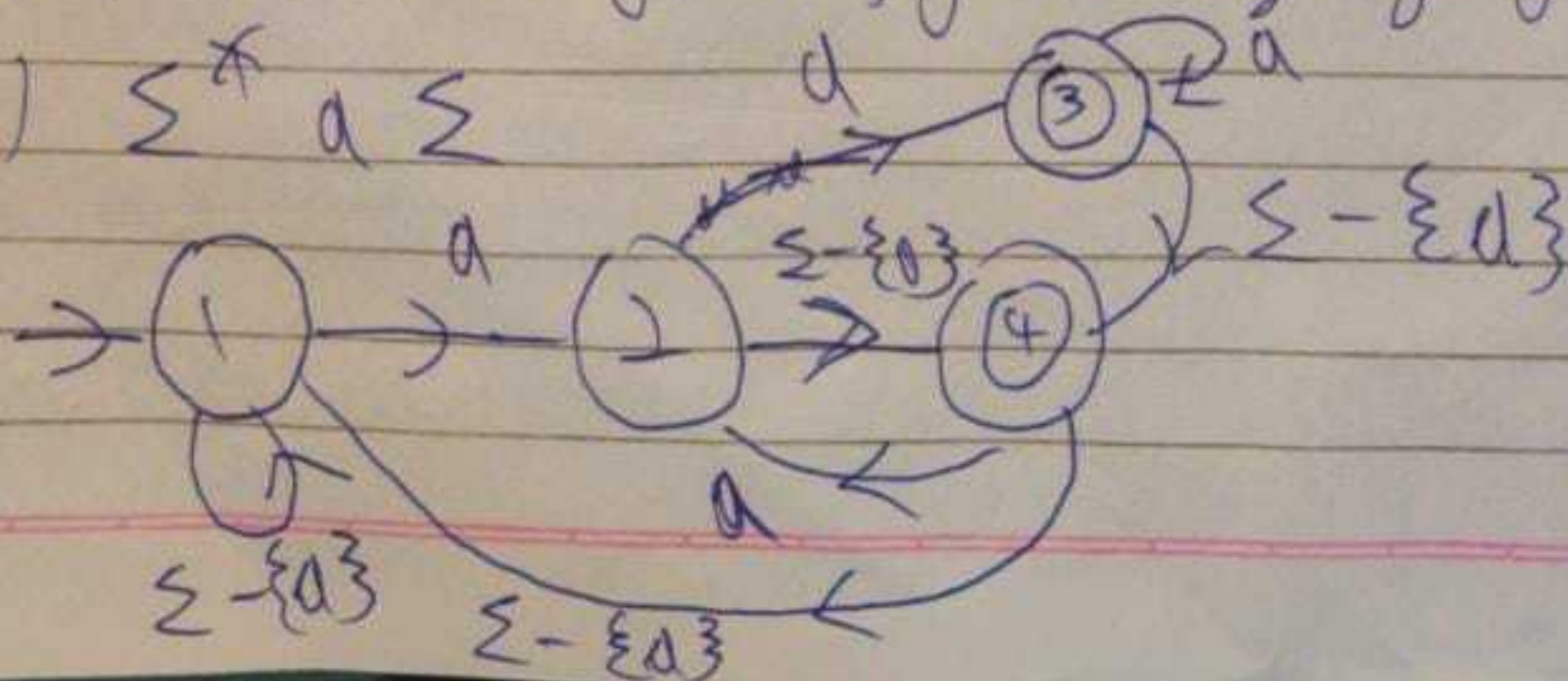
a)  $\Sigma^* b^* a \Sigma^*$

~~$\Sigma^* b a \Sigma^*$~~



3  $\exists x [\theta_1(x) \wedge \exists y [S(x, y) \wedge \forall z [z \leq y]]]$

a)  $\Sigma^* a \Sigma$

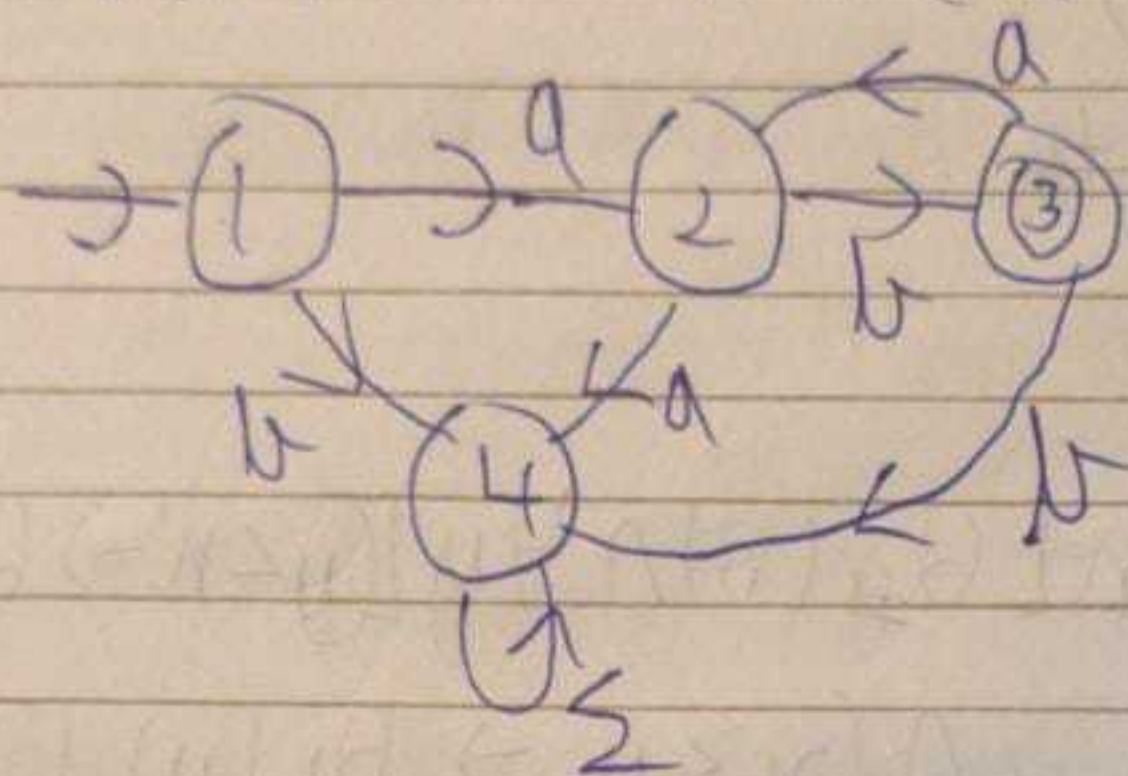




1: Last two symbols: b-b      3. aa

2: Last two symbols: b-a      4. ab

4.  ~~$a(ab)^*b$~~       1)  $a(ba)^*b$



2.  $a(ba)^*$

3.  $a(ba)^*b$



