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RADHIKA PATWARI

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Class test 9 [CS60045 - AI]

2.(a) [1] False

$P(AB) = P(A)P(B) - P(A/B) \Rightarrow P(A)P(B) - \frac{P(A \cap B)}{P(B)}$

$\Rightarrow P(AB)\left(1 + \frac{1}{P(B)}\right) \Rightarrow P(A)P(B)$

LHS $\neq$ RHS

[2] False

$P(AB) \Rightarrow P(A)P(B) \rightarrow$ only when A & B are independent

[3] False

$P(AB) = P(A/B)P(B) + P(B/A)P(A)$

$= \frac{P(AB)}{\cancel{P(B)}}\cancel{P(B)} + \frac{P(BA)}{\cancel{P(A)}}\cancel{P(A)}$

$= 2P(AB)$

Hence $P(AB) = 2P(AB)$ only when $P(AB) = 0$

So it is not always true (invalid)

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[4] True

$P(A) = \sum_{b \in B} P(A|B=b)\, P(B=b)$ is always true

[5] False, [true only when A, B, C are pairwise independent]

$$P(AC) = \sum_{b \in B} \frac{P(AB)}{P(B)} \frac{P(CB)}{\cancel{P(B)}} \cancel{P(B)}$$

$$= \sum_{b \in B} \frac{P(AB)\, P(CB)}{P(B)}$$

They can be true only if A, B, C are pairwise independent and $\sum_{b \in B} P(B) = 1$

$$P(AC) = \sum_{b \in B} \frac{P(A)P(B)\, P(C)\cancel{P(B)}}{\cancel{P(B)}} = P(A)P(C) \sum_{b \in B} P(B)$$

$$P(AC) = P(A)P(C)$$

[6] True

$$P(ABC) = P(C|A)\, P(B|CA)\, P(A)$$

$$= \frac{P(CA)}{\cancel{P(A)}} \frac{P(BAC)}{\cancel{P(CA)}} \cancel{P(A)} = P(BAC)$$

$$= \underline{P(ABC)}$$

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Q.(b) $P(B|\neg A)$

$= \frac{P(B \cap \neg A)}{P(\neg A)}$

$= \frac{P(\neg A \cap B)}{P(\neg A)}$

$= \frac{P(\neg A|B)\, P(B)}{P(\neg A)}$

$= \frac{\left(\frac{1}{3}\right)(0.75)}{(1-0.5)}$

$= \frac{1}{\cancel{3}} \times \frac{\cancel{0.75}^{\cancel{0.25}\ 1}}{0.\cancel{5}\ 2}$

$= \frac{1}{2}$

$= 0.5$

Given

$P(B|A) = \frac{P(B \cap A)}{P(A)} = 1$

$\rightarrow P(B \cap A) = P(A)$
$= 0.5$

$P(B) = 0.75$

$P(A) = 0.5$

$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0.\cancel{50}\ 2}{0.\cancel{75}\ 3}$

$= \frac{2}{3}$

$P(\neg A|B) = 1 - P(A|B)$
$= 1 - \frac{2}{3} = \frac{1}{3}$

(c) [1] $P(ABC) = P(CAB)$

$= P(C|AB)\, P(AB)$

$= P(C|AB)\, P(A)\, P(B)$

(as A & B are independent)

$= (1)(1/4)(3/4)$

$= \frac{3}{16} = 0.1875$

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[2] $P(AB) = P(A)P(B)$

$= \left(\frac{1}{4}\right)\left(\frac{3}{4}\right)$ (as A & B are independent)

$= \frac{3}{16}$

$= \underline{\underline{0.1875}}$

[3] $P(C) = P(CAB) + P(C\bar{A}B) + P(C\bar{B}A) + P(C\bar{A}\bar{B})$

$= P(C|AB)P(AB) + P(C|\neg AB)P(\neg AB)$

$+ P(C|A,\neg B)\, P(A,\neg B)$

$+ P(C|\neg A\neg B)\, P(\neg A,\neg B)$

$= (1)(P(A)\,P(B)) + \frac{1}{2}(P(\neg A)\,P(B))$

$+ \cancel{(0)(P(A)\,P(\neg B))} + \cancel{(0)\,P(\neg A)P(\neg B)}$

$= P(A)\,P(B) + \frac{1}{2}(P\neg(A))\,P(B)$

$= P(A)\,P(B) + \frac{1}{2}(1 - P(A))\,P(B)$

$= \left(\frac{1}{4}\right)\left(\frac{3}{4}\right) + \frac{1}{2}\left(1 - \frac{1}{4}\right)\left(\frac{3}{4}\right)$

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$$= \frac{3}{16} + \frac{9}{32} = \frac{6+9}{32} = \frac{15}{32}$$

$$= 0.46875$$

[4] $P(B|C)$

$$= \frac{P(B \cap C)}{P(C)} = \frac{P(C|B)\,P(B)}{P(C)} = \frac{P(CBA) + P(CB\bar{A})}{P(C)}$$

$$= \frac{P(C|BA)\,P(BA) + P(C|B\bar{A})\,P(B\bar{A})}{P(C)}$$

$$= \frac{P(C|AB)\,P(A)\,P(B) + P(C|\bar{A}B)\,P(\bar{A})\,(P(B))}{P(C)}$$

$$= \frac{(1)(1/4)(3/4) + (1/2)(3/4)(3/4)}{15/32}$$

$$= \frac{\frac{3}{16} + \frac{9}{32}}{\frac{15}{32}} = \frac{\cancel{\frac{15}{32}}}{\cancel{\frac{15}{32}}} = 1$$

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[5] $P(AB|C) = \dfrac{P(ABC)}{P(C)}$

$= \dfrac{P(ABC)}{P(C)}$

$P(ABC) = \dfrac{3}{16}$ from [1]

$= \dfrac{3/16}{15/32} = \dfrac{2}{5} = \underline{0.4}$

$P(C) = \dfrac{15}{32}$ from [3].

$\therefore \; \underline{P(AB|C) = 0.4}$

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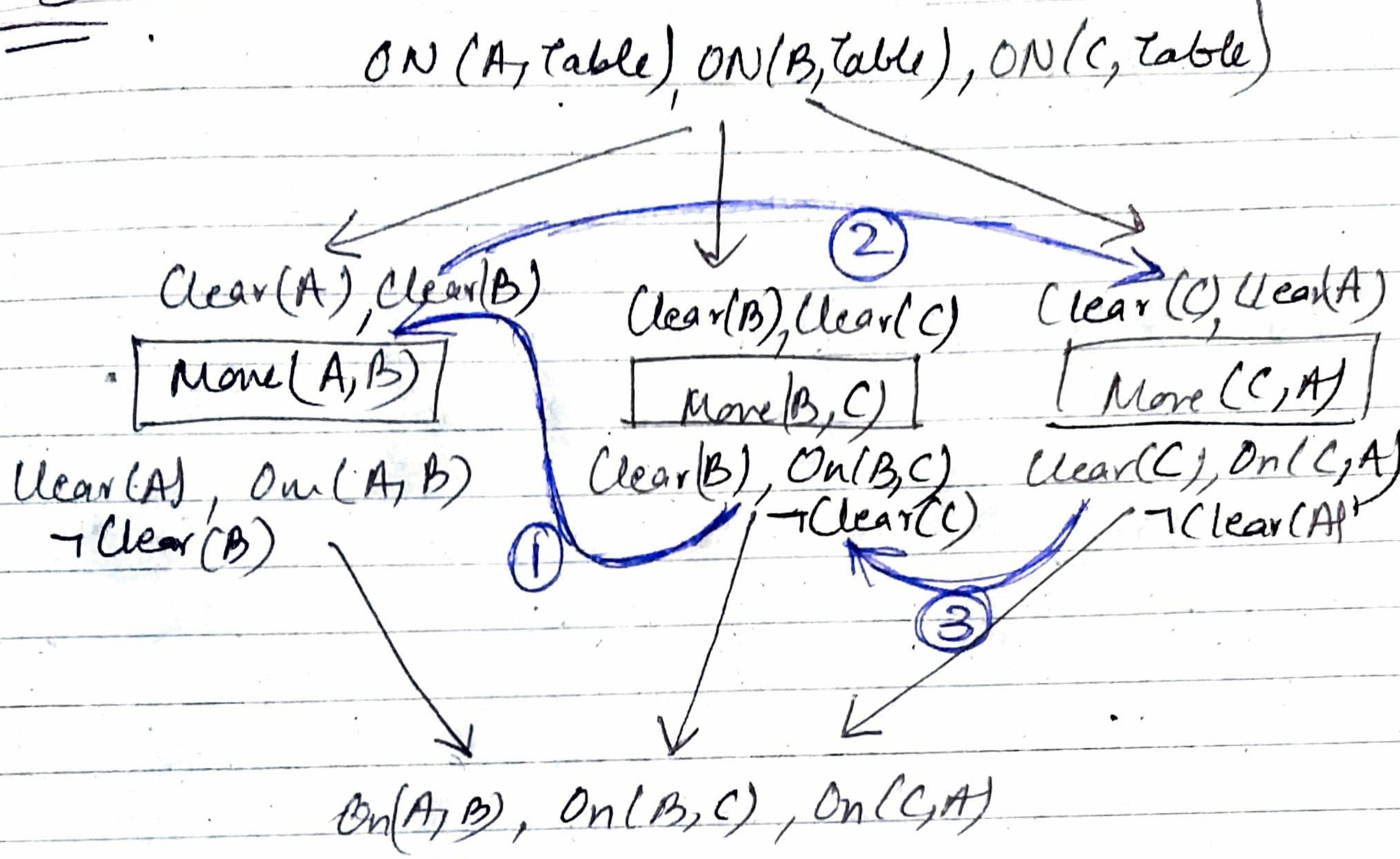
3.



Step ① is a possible way to reach
On(A,B), On(B,C), Clear(A)

Step ② is a possible way to reach
On(A,B), On(C,A), Clear(C)

Hence all 3 condition for goal state cannot be satisfied simultaneously

As if we take ①→②, preconditions Clear(C) contradicts.
If we take ②→③, Precondition Clear(B) contradicts.

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Q No Step S exists such that

Start < S' < Finish

where Start → On(A, Table), On(B, Table), On(C, Table)
Finish → O(A, B), On(B, C), On(C, A)

∴ No partial order planning is possible

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Given

1. $A, B, C \rightarrow \boxed{\text{Action 1}} \rightarrow \neg D$

$\neg A, \neg B \rightarrow \boxed{\text{Action 2}} \rightarrow A, B$

$\neg B, \neg C \rightarrow \boxed{\text{Action 3}} \rightarrow B, C$

$B \rightarrow \boxed{\text{Action 4}} \rightarrow \neg B$

Start State : $\neg A, \neg B, \neg C, D$

Goal ; $A, B, C, \neg D$

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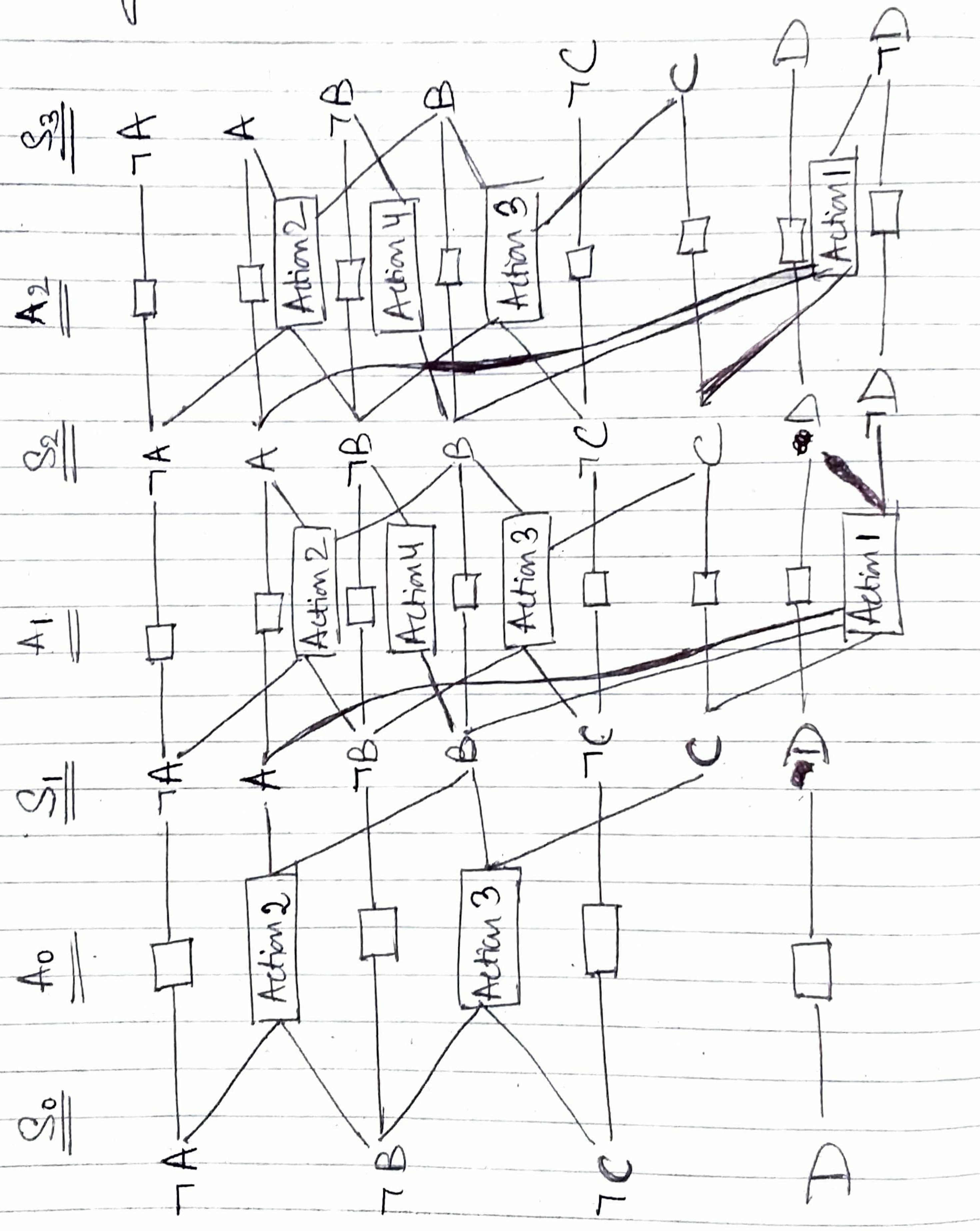
1.(a)

Planning Graph



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1.

(c) [1]

In A_1, Action 3 and Action 4 have mutex relation

Action 3 causes B
Action 4 causes $\neg B$

[2] In A_1,

Action 4 causes $\neg B$
Action 1 has precondition of B
Action 4 and 1 have interference

[3]

In A_1,

Action 2 has precondition $\neg B$
Action 4 has precondition B

Action 2 and 4 have competing needs

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1.

(d) State level S_3

as all possible states of A, ¬A, B, ¬B, C, ¬C, D, ¬D have reached.

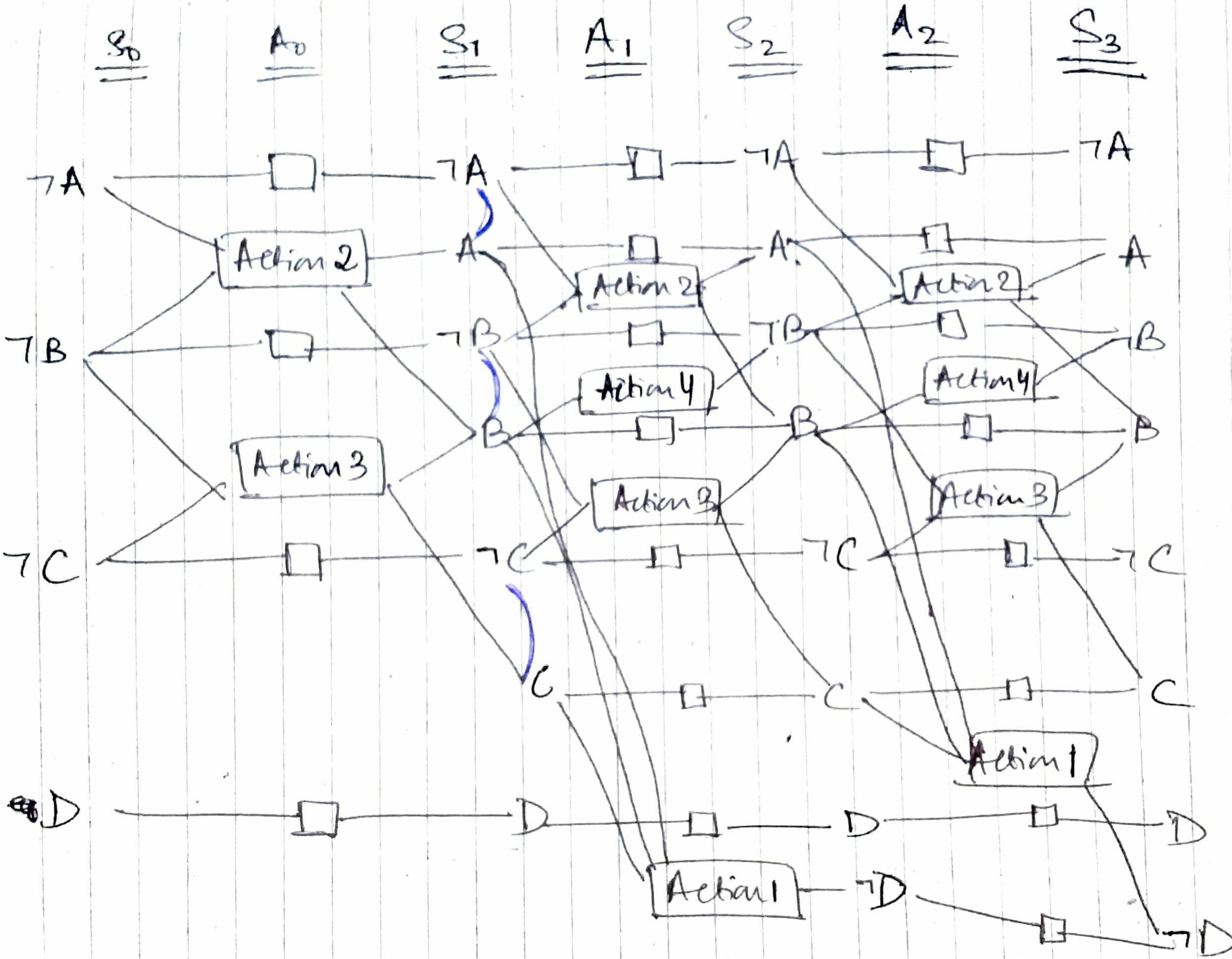
In all possible levels after this, No. of states and mutex will be constant

Yes, possible to obtain a solution in the final state level S_3 due to absence of mutex locks among values of final state.

(e) Minimum value of k = 2

As the states in S_2 and S_3 are same.

1.(b)


S0
A0
S1
A1
S2
A2
S3
¬A
A
¬B
B
¬C
C
D
¬D
Action 2
Action 3
Action 2
Action 4
Action 3
Action 1
Action 2
Action 4
Action 3
Action 1