CENG424

Logic for Computer Science

Assignment 4

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Question 1

Clausal form of the premises are as the following;

• Everyone whom Jane loves is a traveler.
$\forall x(LOVES(Jane, x) \implies TRAVELER(x)) \equiv \neg LOVES(Jane, x) \vee TRAVELER(x)$

• Any person who does not earn money, does not travel.
$\forall x(\neg EARN(x) \implies \neg TRAVEL(x)) \equiv EARN(x) \vee \neg TRAVEL(x)$

• Jim is a doctor.
$DOCTOR(Jim)$

• Every doctor is a person.
$\forall x(DOCTOR(x) \implies PERSON(x)) \equiv \neg DOCTOR(x) \vee PERSON(x)$

• Any doctor who does not work, does not earn money.
$\forall x((DOCTOR(x) \wedge \neg WORK(x)) \implies \neg EARN(x)) \equiv \neg DOCTOR(x) \vee WORK(x) \vee \neg EARN(x)$

• Anyone who does not travel, is not a traveler.
$\forall x(\neg TRAVEL(x) \implies \neg TRAVELER(x)) \equiv TRAVEL(x) \vee \neg TRAVELER(x)$

The goal is as the following:
• If Jim does not work, then Jane does not love Jim.
$\neg WORK(Jim) \implies \neg LOVES(Jane, Jim) \equiv WORK(Jim) \vee \neg LOVES(Jane, Jim)$

To use relational resolution, the goal should be negated.
$\neg(WORK(Jim) \vee \neg LOVES(Jane, Jim)) \equiv \neg WORK(Jim) \wedge LOVES(Jane, Jim)$

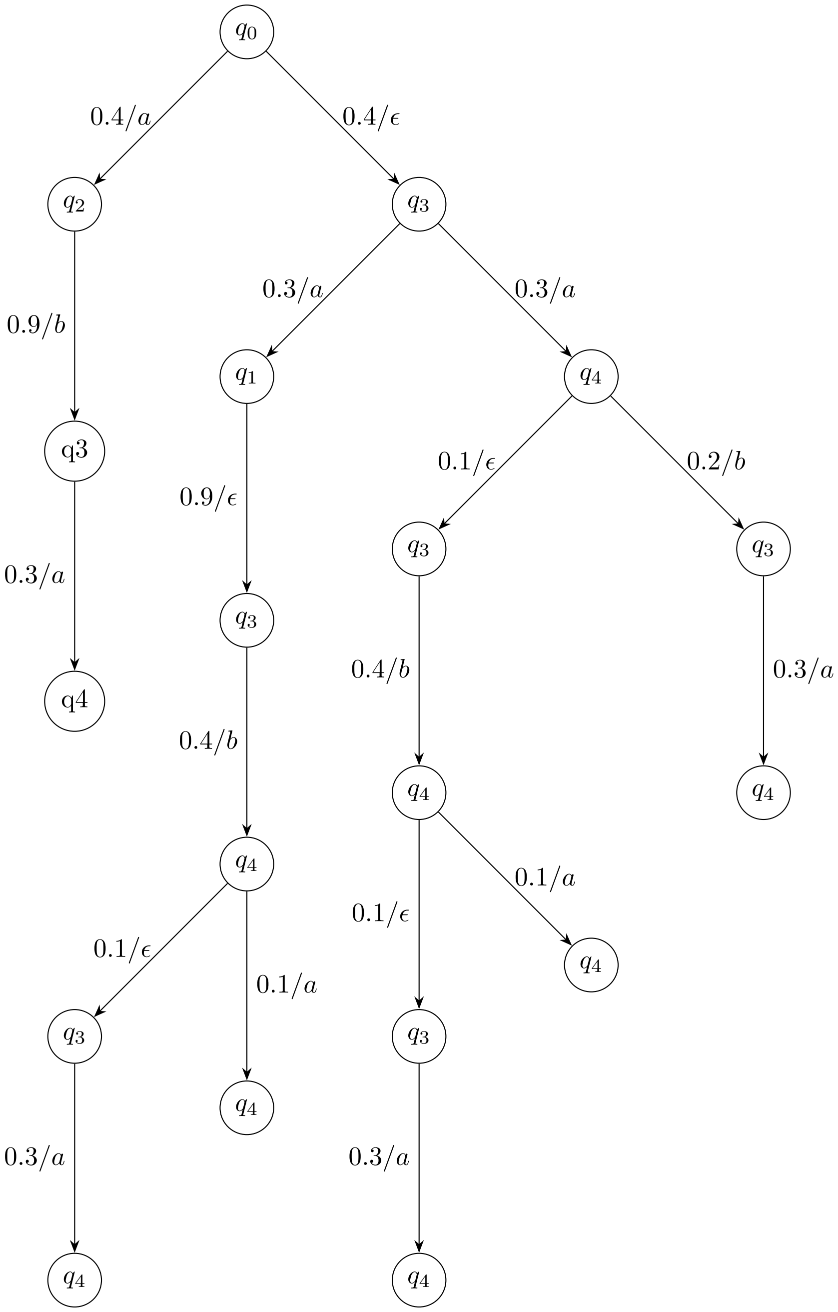
1.	$\{\neg LOVES(Jane, x), TRAVELER(x)\}$	Premise
2.	$\{EARN(x), \neg TRAVEL(x)\}$	Premise
3.	$\{DOCTOR(Jim)\}$	Premise
4.	$\{\neg DOCTOR(x), PERSON(x)\}$	Premise
5.	$\{\neg DOCTOR(x), WORK(x), \neg EARN(x)\}$	Premise
6.	$\{TRAVEL(x), \neg TRAVELER(x)\}$	Premise
7.	$\{\neg WORK(Jim)\}$	Negated Goal
8.	$\{LOVES(Jane, Jim)\}$	Negated Goal
9.	$\{TRAVELER(Jim)\}$	1,8
10.	$\{TRAVEL(Jim)\}$	6,9
11.	$\{EARN(Jim)\}$	2,10
12.	$\{\neg DOCTOR(Jim), WORK(Jim)\}$	5,11
13.	$\{\neg DOCTOR(Jim)\}$	7,12
14.	$\{\}$	3,13

Question 2

a.

$TRANSITION(q, q', p)$ for the transition from state q to state q' with the probability p.

b.



c.

$TRANSITION(q_0, q_2, 0.4)$
$TRANSITION(q_0, q_3, 0.4)$
$TRANSITION(q_1, q_3, 0.9)$
$TRANSITION(q_2, q_3, 0.9)$
$TRANSITION(q_3, q_1, 0.3)$
$TRANSITION(q_3, q_4, 0.3)$
$TRANSITION(q_3, q_4, 0.4)$
$TRANSITION(q_4, q_3, 0.1)$
$TRANSITION(q_4, q_3, 0.2)$

$TRANSITION(q_4, q_4, 0.1)$

d.

$TWOTRANSITIONS(q_{abc}, p) \iff TRANSITION(q_a, q_b, p_1) \wedge TRANSITION(q_b, q_c, p_2) \wedge (p = p_1 \times p_2)$ for the probability of going from q_a to q_c by stopping at q_b where p is calculated by multiplying the probability of transitioning from q_a to q_b and q_b to q_c.
$THREETRANSITIONS(q_{abcd}, p) \iff TRANSITION(q_a, q_b, p_1) \wedge TWOTRANSITIONS(q_{bcd}, p_2) \wedge (p = p_1 \times p_2)$ which means $THREETRANSITIONS(q_{abcd}, p) \iff TRANSITION(q_a, q_b, p_1) \wedge (TRANSITION(q_b, q_c, p_3) \wedge TRANSITION(q_c, q_d, p_4) \wedge (p_2 = p_3 \times p_4)) \wedge (p = p_1 \times p_2)$.

e.

$TRANSITION(q_0, q_2, 0.4)$
$TRANSITION(q_2, q_3, 0.9)$
$TRANSITION(q_3, q_4, 0.3)$
$TWOTRANSITIONS(q_{234}, 0.27)$
$THREETRANSITIONS(q_{0234}, 0.108)$