Middle East Technical University | Department of Computer Engineering

CENG 424

Logic For Computer Science

Fall 2024-2025

Assignment 3

Regulations

1. The homework is due by **23:55 on December 2nd, 2024**. Late submission is not allowed.
2. Submissions will be via ODTUClass, do not send your homework via e-mail.
3. You typeset your homework in any typesetting tool (LaTex, Word, etc.) or submit handwritten answers. However, you must upload the homework as a single **pdf file**. Other formats will not be considered for grading. In case you submit handwritten solutions, **make sure that the page layouts are properly organized and your answers are clear and readable.**
4. Write your names and surnames to each of your pages.
5. Name your submission files as $< yourName\_yourSurname\_424HW3 >$.pdf.
6. Send an e-mail to **garipler@metu.edu.tr** if you need to get in contact.
7. **This is an individual homework, which means you have to answer the questions on your own. Any contrary case including but not limited to getting help from automated tools, sharing your answers with each other, extensive collaboration etc. will be considered as cheating and university regulations about cheating will be applied.**

Question 1

Translate the following sentences into relational logic. For each sentence, state what your constants (relation, function, and object constants) mean.

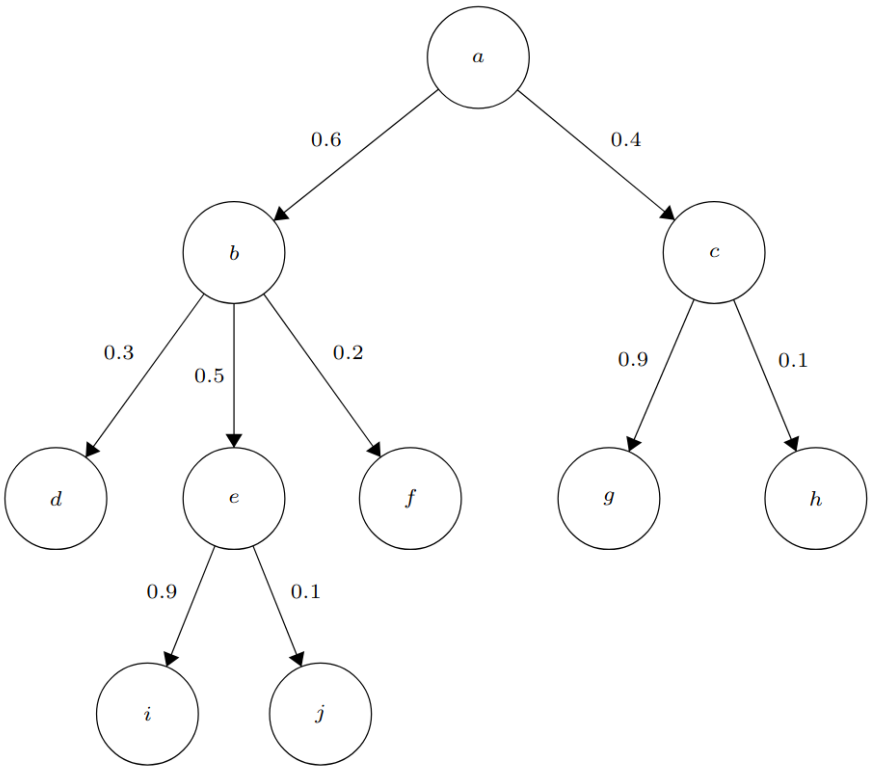
1. The only thing I know is that I know nothing.
2. A period is a punctuation mark that indicates an abbreviation or the end of a sentence.

Question 2

Prove the validity of the following sequent using the deduction methods covered in class.

$$\forall x(P(x) \vee Q(x)), \exists x \neg Q(x), \forall x(R(x) \Rightarrow \neg P(x)) \vdash \exists y \neg R(y)$$

Question 3



Given the probabilistic computation tree above, use natural deduction to compute the probability of the computation ending at node j. Show the steps of your solution.

Hint1: The answer will be a byproduct of the proof.
Hint2: Begin with creating your small knowledge base (i.e. set of premises) which represents the knowledge depicted by the given tree. You can represent a transition from x to y with probability p with the predicate $P(x, y, p)$.
Hint3: If there is a transition from x to y with probability p_1 and a transition from y to z with probability p_2, then probability of reaching z from x is $p_1 \times p_2$. Formalize and use this fact.