

CSCI3230 Fundamentals of Artificial Intelligence
Information Theory and Logic Assignment
Due date: 23:59:59 (GMT +08:00), 6th December, 2019

I. Questions

- a) For a discrete random variable V with n possible values v_i , each has probability P_i . The Information Content (I) is given by: $I(V) = \sum_{i=1}^n -P_i \log_2 P_i$, with the convention that $0 \times \log_2 0 = 0$. The minimum value of $I(V)$ is 0. The maximum value of $I(V)$ is $\log_2 n$. Please interpret the situation where $I(V) = 0$ and $I(V) = \log_2 n$ respectively. [8 marks]

- b) 1. Express each of the following statements knowledge base as **First Order Logic sentences** (Together with $\wedge, \vee, \Rightarrow, \neg, \forall, \exists$). [8 marks]

Any student who can pass the computer exam ($Pass(x, computer)$) and find a job ($Find(x, job)$) is happy ($Happy(x)$).

Any student who is intelligent ($Intelligent(y)$) or is hardworking ($Hardworking(y)$) can pass all the exams.

John is not intelligent ($Intelligent(John)$) but he is hardworking ($Hardworking(John)$).

Any hardworking ($Hardworking(w)$) student can find a job ($Find(w, job)$).

2. Convert your answer in b)1 into Conjunctive Normal Form (CNF). [8 marks]
3. Prove that John is happy (i.e. $Happy(John)$) by **Resolution** given the sentences in conjunctive normal form (CNF) in question (b)2 . You must show your proof step by step including all the unifications and substitutions used. Explain your proof approach briefly. [16 marks]
4. What is higher-order logic? Give a simple example. [4 marks]

- c) 1. How to evaluate the performance of a classification model? [2 marks]
2. What is the limitation of accuracy? [2 marks]
3. What is the limitation of F-measure? [2 marks]

II. Assignment Submission

You **MUST** complete this assignment by using any one of the computer text editors (e.g. MS Word, WordPad, iWork Pages... etc.) and then save the document to PDF format with A4 printable page size. Scan version of the hand written work is **NOT** accepted. Please limit the file size of the PDF file less than 1MB.

You **MUST** submit the PDF file to the submission system on our course homepage (within CUHK network), otherwise, we will **NOT** mark your assignment.

III. Important Points

You **MUST** STRICTLY follow these points:

- a. You **MUST** strictly follow the submission guidelines.
- b. Remember to type your **FULL NAME, STUDENT ID** on the assignment.
- c. Late submission will **NOT** be entertained according to our submission system settings.
- d. Plagiarism will be seriously punished.

IV. Late Submission

According to the course homepage, late submission will lead to marks deduction.

No. of Days Late	Marks Deduction
1	10%
2	30%
3	60%
4 or above	100%