

科目：人工智慧(A)

日期：101 年 7 月 25 日 第 1 頁 共 2 頁

請“✓”明 ✓不可看書 可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. (10pts total) Translate the following sentences into first-order logic, using the two predicates only: (i) taller(X,Y), i.e., X is taller than Y, and (ii) shorter(X,Y), i.e., X is shorter than Y.
 - (a) (1pt) Helen is taller than John.
 - (b) (2pts) No one is taller than David.
 - (c) (1pts) Linda and Mary are taller than Tom.
 - (d) (3pts) For all x and y, if x is taller than y, then y is shorter than x.
 - (e) (3pts) No one is taller than everyone.
2.
 - (a) (2pts) In the worst case, how much time is required to determine if a Boolean formula with n variables is satisfiable? (in big O notation)
 - (b) (2pts) If you are doing a resolution proof, and you have k clauses, for just the first step in the proof, how many possible resolutions might you have? (in big O notation)
 - (c) (3pts) Consider the statement $\forall x \exists y (x > y)$. For x and y, give a numeric domain for which this is a true statement.
 - (d) (3pts) For the preceding statement, give a numeric domain for which the statement is not true.
3. The following is the knowledge base for a medical diagnosis problem: in generals, x represents a patient, y is a hospital employee, and z is the day of the week.
 - R1. If high-temperature(x) and positive-testA(x) then flu(x)
 - R2. If high-temperature(x) and negative-testB(x) then stomach-infection(x)
 - R3. If positive-testB(x) then appendix(x)
 - R4. If normal-blood-pressure(x) and adult(x) then can-operate(x)
 - R5. If appendix(x) and can-operate(x) and insured(x) then plan-surgery(x)
 - R6. If health-insurance-card(x) then insured(x)
 - R7. If plan-surgery(x) and surgeon-available(y,z) then schedule-surgery(x,y,z)
 - R8. If Monday-Friday(z) and surgeon(y) then surgeon-available(y,z)
 - R9. If stomach-infection(x) and doctor(y) then write-prescriptioin(y,x)
 - R10. If surgeon(y) then doctor(y)
 - R11. If on-staff(y) and y=Dr. Jones then doctor(y)
 - R12. If on-staff(y) and y=Dr. Wong then surgeon(y)
 - R13. If age(x)>17 then adult(x)

Forward chaining is used with the following assumptions:

1. The working memory contains the predicates currently in use.

◎請用深黑色鋼筆或原子筆出題

命題老師簽名：

科目：人工智慧(A)

日期：101 年 7 月 25 日 第 2 頁 共 2 頁

2. If a rule is fired, the consequence is added to the working memory right away.
3. Rules are fired only once with the same unification.

4. Rules are scanned in numerical order from R1 to R13.
5. When the end of the rules is reached, rule-scanning is restarted from the first rule.
6. If no rule is fired during a complete scan from the knowledge base, the process halts.

Joe is a patient with high-temperature, has tested positive on testB, is 20 years old, has a health insurance card and has normal blood pressure. He shows up at the emergency room on Tuesday, and Dr. Wong is on-staff that day. Note. No partial credits for incomplete or incorrect answers.

- (a) (5pts) Show the content of the current working memory, e.g. high-temperature(Joe).
- (b) (10pts) Show the sequence of rules (in order) which are fired using forward chaining. The first one is done for you: R3 -> appendix(Joe).

4. It has long been claimed (by some AI researchers) that every (well, almost) problem can be treated as a search problem. Now consider the following problem you might have.

Suppose you are looking for a smartphone that best meets your needs. Let's assume that your requirements include the following: (1) good User Interface, (2) quality Apps, (3) flexible OS, (4) stable OS, (5) upgradability and (6) cost (phone, Apps and phone bills).

What your requirements may involve the factors below that could affect your final decision.

- There are currently three major smartphone operating systems, i.e. Android, iOS and Windows, meaning you can pick any of them.
- What makes this problem even more challenging and interesting (in a sense) is that there are numerous phone makers, e.g. Apple, hTC, Samsung, SONY, etc, and you can buy your phone from any of them.
- In addition, you can either stick with Chunghwa Telecom, Taiwan Mobile, Vibo or FarEastone.
- There are many vendors that carry these phones, e.g. phone retailers, chain stores, telecom company branch stores, etc., meaning you can buy your phone from any of them.
- Service after purchase, e.g. location of service points, turnaround time, etc.

Now translate the task of your smartphone procurement into a search problem.

(15pts) Define the search problem by the four components introduced in AI textbook. Note. You are required to describe the four components clearly, but no more than 500 words totally. Any excessive word will incur a deduction of points. Your answer will be evaluated against the others, and the grades will be given on a comparative basis.

科目：人工智慧(B)

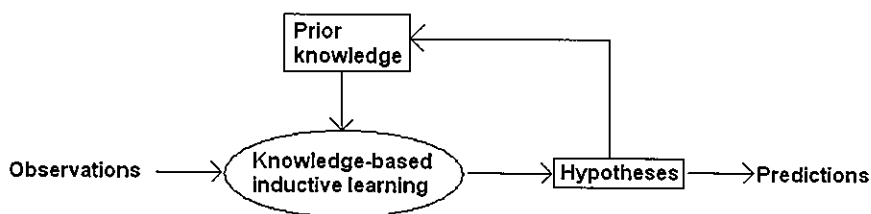
日期：101 年 7 月 25 日 第 1 頁 共 1 頁

請“✓”明 ✓不可看書 可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. (10pts) Consider the problem of air freight transport, where certain goods must be transported from an airport to another airport by plane and where airplanes need to be loaded and unloaded. The necessary actions would be *loading*, *unloading* and *flying*; over the descriptors one could express $In(c, p)$ and $At(x, a)$ whether a freight c is in an airplane p and whether an object x is at an airport a .
 - (a) Write the three action schemas in Planning Domain Definition Language (PDDL).
 - (b) What is the primary difference between the two planning languages: PDDL and STRIPS?
2. (10pts) What is meant by the term *over-fitting* in the context of inductive learning? Give an example of over-fitting in (a) decision tree learning, and (b) multi-layer perceptrons learning, respectively. Next, suggest a method to prevent the inductive learning process from over-fitting in general.
3. (15pts) Explain the following terms in the given context.
 - (a) Forward and backward chaining in logic reasoning.
 - (b) Closed World Assumption (CWA) and Unique Names Assumption (UNA) in default reasoning.
 - (c) The Frame Problem and Frame Axioms in knowledge representation.
 - (d) The least commitment principle in version space learning.
 - (e) Explanation-based learning and Relevance-based learning in the following figure.



4. (15pts) Genetic algorithms can be used as a method for (a) search, (b) optimization, and (c) machine learning. Give an example for each application and explain how the GA serves that purpose. Note, be as specific as you can, for instance, do NOT interpret an optimization problem as a search problem.