

# COMP 210 Second Assignment, May 2010

Worth 10% of total marks for the module

TIME ALLOWED : 50 minutes

Electronic devices are not permitted

Name: \_\_\_\_\_ ID: \_\_\_\_\_

Please answer the following multiple-choice questions. **All questions are of equal weight.**

1. The following text describes a well known method of knowledge representation.

It is a labelled graph where nodes in the graph represent objects, concepts, or situations, and arcs in the graph represent relationships between objects.

What form of knowledge representation is being described?

- A. A rule based system.
- B. A semantic network.
- C. A frame based system.
- D. A script.
- E. A representation using logic.

2. In terms of knowledge representation a *script* is

- A. a variant on frames for representing stereotypical events.
- B. a variant on semantics networks for representing stereotypical events.
- C. a variant on semantics networks for representing quantified statements.
- D. part of the architecture of a rule based system.
- E. an algorithm for applying rules in a rule based system.

3. Which of these **would not** normally be found in an expert system?

- A. Rules about the domain.
- B. Problem solving rules.
- C. A user interface.
- D. Facts about particular cases.
- E. An inference engine.

4. The following shows a natural deduction proof of  $p \Rightarrow (q \Rightarrow r), p \wedge q \vdash r$  where the explanation for steps 3–6 is missing.

1.  $p \Rightarrow (q \Rightarrow r)$  Given
2.  $p \wedge q$  Given
3.  $p$
4.  $q \Rightarrow r$
5.  $q$
6.  $r$

How have lines 5. and 6. of the proof been obtained from lines 1–4?

- A. 5. line 2  $\wedge$  elimination; 6. line 4  $\wedge$  elimination.
- B. 5. line 2  $\wedge$  elimination; 6. lines 1,3  $\Rightarrow$  elimination.
- C. 5. line 2  $\wedge$  elimination; 6. lines 4,5 modus ponens.
- D. 5. line 4  $\Rightarrow$  elimination; 6. lines 4,5 modus ponens.
- E. 5. lines 3,4 modus ponens; 6. lines 4,5 modus ponens.

5. Which of the following are advantages of breadth-first search over depth-first search.
- A. Breadth-first search is guaranteed to find a solution if one exists.
  - B. Breadth-first search finds the shortest solution.
  - C. The memory requirement for breadth-first search is, in general, less than for depth-first search.
  - A. I only.
  - B. II only.
  - C. III only.
  - D. I and II only.
  - E. I, II and III.
6. In a Backward Chaining rule based system, given a production rule,  $c \rightarrow a$ , if  $a$  is currently a goal  $c$  is added
- A. as a fact in working memory.
  - B. to the explanation system.
  - C. to the inference engine.
  - D. the knowledge base.
  - E. as a goal in working memory.
7. The use of the Turing Test falls into which area of Artificial Intelligence?
- A. Acting humanly.
  - B. Acting rationally.
  - C. Expert systems.
  - D. Thinking humanly.
  - E. Thinking rationally.

8. The property that *all valid inferences can be derived* is a desirable feature of a Knowledge Representation Schema. This property is known as
- A. completeness.
  - B. naturalness.
  - C. representational adequacy.
  - D. soundness.
  - E. well defined syntax.
9. A formula  $p \rightarrow q$  is false if
- A. both  $p$  and  $q$  are true.
  - B.  $p$  is true and  $q$  is false.
  - C.  $p$  is false and  $q$  is true.
  - D. both  $p$  and  $q$  are false.
  - E. neither  $p$  nor  $q$  are true.

10. The water jugs problem is given below.

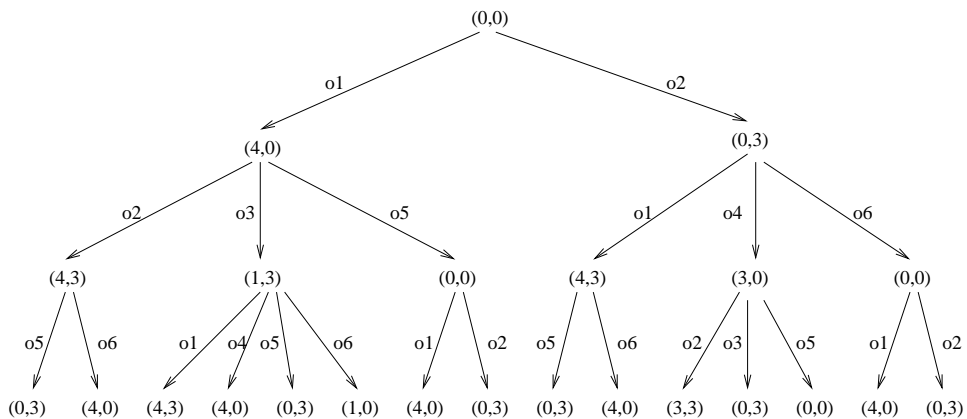
Your are given two empty jugs, a 4-gallon one and a 3-gallon one, with no markings on. There is a tap that can be used to fill the jugs up with water, pour (as much as possible) from one jug to another and you can empty any jug at any time. The goal is to get exactly 2 gallons into a jug?

This is represented as a search problem below.

- States are represented as  $(a, b)$  where  $0 \leq a \leq 4$  represents the amount in the 4 gallon jug and  $0 \leq b \leq 3$  represents the amount in the 3 gallon jug.
- Initial state  $(0, 0)$
- Goal states  $(2, x)$  or  $(x, 2)$  where  $x$  stands for volume of water.
- The operations are:-
  - $o_1$  fill the 4 gallon jug
  - $o_2$  fill the 3 gallon jug
  - $o_3$  pour (as much as will fit of) the contents of the 4 gallon container into the 3 gallon container
  - $o_4$  pour (as much as will fit of) the contents of the 3 gallon container into the 4 gallon container
  - $o_5$  empty the 4 gallon container
  - $o_6$  empty the 3 gallon container

We assume that applying an operation to state  $s$  results in state  $s'$  where  $s$  and  $s'$  are different (for example we can't apply  $o_1$  when the 4 gallon jug is already full).

A search tree to depth 3 is given below.



The search path  $(0, 0), (4, 0), (4, 3), (0, 3), \dots$  is known as

- A. A\* search.
- B. breadth-first search.
- C. depth-first search.
- D. depth-limited search.
- E. iterative deepening.

11. The following shows a partially constructed truth table for the formula  $((p \vee q) \Rightarrow \neg r)$ .

$p$	$q$	$r$	$p \vee q$	$\neg r$	$((p \vee q) \Rightarrow \neg r)$
$T$	$T$	$T$	$T$	$F$	$F$
$T$	$T$	$F$			
$T$	$F$	$T$			
$T$	$F$	$F$			
$F$	$T$	$T$			
$F$	$T$	$F$			
$F$	$F$	$T$			
$F$	$F$	$F$			

How should the *last* row of the truth table be completed?

- A. T T T
- B. F T T
- C. F T F
- D. T F F
- E. F F F

12. Using the truth table above, the formula  $((p \vee q) \Rightarrow \neg r)$  can be classified as

- A. contradictory.
- B. satisfiable.
- C. a tautology.
- D. unsatisfiable.
- E. valid.

13. In the formula  $\exists x\forall y(Mx \wedge Sy \rightarrow Pxy)$ , M means *is a man*, S means *is a sport* and Pxy means *x plays y*. Which of these is the meaning of the formula?

- A. Some men play sport.
- B. There is a sport that every man plays.
- C. All men play every sport.
- D. Some sports are played by no men.
- E. There is a man who plays every sport.

14. The following is a set of clauses in propositional logic.

1.  $p \vee q \vee \neg r$
2.  $\neg p$
3.  $r \vee q$
4.  $p \vee \neg q$

Which of the following clauses **cannot** be obtained by applying the resolution inference rule (and simplification) to pairs of the above clauses?

- A.  $p \vee q$
- B.  $p \vee \neg r$
- C.  $q \vee \neg r$
- D.  $\neg q \vee \neg r$
- E.  $r \vee p$

15. AI is not widely used in law. Which of these is not one of the reasons?

- A. Lawyers are not early adopters of technology.
- B. Laws can be interpreted in a variety of ways.
- C. Deduction plays no part in legal reasoning.
- D. The law frequently changes.
- E. People prefer to have their case decided by a human being.