Polytechnic University CS-661 AI Final Exam

December 1997 Prof. Jonathan Stein

Answer questions 1 — 25 with **A, B, C, D, All** or **None** (2 points each).

1. AI agents **A** have perceptors and effectors. **B** may or may not have internal states. **C** may be humanlike or rational. **D** strive to maximize their performance.

2. A simple reflex agent **A** has finite memory. **B** is goal based. **C** measures its utility. **D** is a general problem solver.

3. A knowledge-based agent **A** uses *TELL* and *ASK* on its internal KB. **B** uses *TELL* and *ASK* on its environment. **C** always uses a formal logic. **D** can not be replaced with a lookup table.

4. The Turing test is **A** a test for consciousness. **B** a test for Turing machines. **C** a problem in natural language processing. **D** a test for the intelligence of agents.

5. What is the Chinese room experiment? **A** A room translates from Chinese to English. **B** A book and a stack of papers understands Chinese. **C** A book and a stack of papers converses in Chinese. **D** Another form of the Turing test.

6. GOFAI is **A** old fashioned. **B** the statement that all computers are capable of intelligence. **C** the statement that there are things human can do but a computer can't. **D** everything that hasn't yet been done by a computer.

7. Strong AI claims that **A** All intelligent machines are conscious. **B** All intelligent machines are isomorphic to each other. **C** The same intelligent software can run on many architectures. **D** At a high enough level a machine that passes the Turing test and a human are essentially the same.

8. The computational complexity of GOFAI problems **A** is always exponential. **B** increases with the sophistication of the technique. **C** is low for truly intelligent agents. **D** tends to be at least NP complete.

9. NP complete problems are **A** hard problems that require nondeterministic solutions. **B** hard problems involving nondeterministic polynomials. **C** the hardest problems that can be checked in polynomial time. **D** problems that can only be solved in exponential time.

10. The Travelling Saleman Problem is **A** to visit cities without recrossing your path. **B** to minimize distance travelled without revisiting cities. **C** to minimize revisiting of cities and return home. **D** a problem that is provably hard to solve.

11. What is Gödel's theorem? **A** Principia Mathematica is redundant. **B** All axiomatic theories have incorrect theorems. **C** All sufficiently strong axiomatic theories are incomplete. **D** It can't be predicted whether a program will halt.

12. A *meta* language is a **A** langauge with which to describe a language. **B** language described by a language. **C** language stronger than natural language. **D** formal language.

13. **A** Breadth first search is incomplete but optimal. **B** Depth first search is optimal and complete. **C** Depth first search is always faster than breadth first. **D** Iteratively deepening search is faster than breadth first.

14. Informed Search **A** can use breadth first and depth first search. **B** requires more information than uninformed search. **C** is incorrectly called *best first search.* **D** includes greedy, least accumulated cost and $A*$.

15. Heuristic functions **A** are useful strategies for solving problems. **B** quantify the usefulness of expanding certain nodes. **C** specify the node to expand irrespective of the search strategy. **D** always minimize search time.

16. The $A*$ algorithm is **A** an optimal informed search algorithm. **B** a blind search algorithm. **C** a program that passes the Turing test. **D** a form of greedy search.

17. Rewrite systems **A** are mechanical inference mechanisms. **B** all have the strength of Turing machines. **C** require meta-rules. **D** test wffs and semantic meaning.

18. Which of the following is a sufficient set of operators in propositional logic? **A** AND **B** AND and OR **C** NAND **D** IF and IFF

19. $\forall$ and $\exists$ **A** are both needed in predicate logic. **B** are defined in propositional logic. **C** can be interchanged using DeMorgan's laws. **D** imply uniqueness.

20. Higher order logic is stronger than predicate logic in that it **A** allows quantification of predicates. **B** uses multivalued variables. **C** has more logical operators. **D** is the meta-language of predicate logic.

21. Declarative programming languages **A** are exemplified by `LISP` and `PROLOG`. **B** are strictly stronger than procedural ones. **C** have assignment statements and iteration. **D** use side effects when procedural effects are needed.

22. `PROLOG` **A** uses breadth first search. **B** has a strong pattern matching facilitiy. **C** is equivalent to predicate logic. **D** uses forward chaining.

23. Variables in `PROLOG` **A** start with a small letter. **B** are all implicitly universally quantified. **C** are all implicitly existentially quantified. **D** instantiate by matching.

24. An expert system **A** can not be written in a procedural language. **B** has a knowledge base and an inference engine. **C** captures common sense knowledge. **D** is never uncertain about its conclusions.

25. The Blocks World program **A** had a robot arm that moved blocks. **B** was written in Prolog. **C** involved a nontrivial microworld. **D** solved the Turing test for the first time.

Define the following in one or two sentences (2.5 points each).

- 26. learning
- 27. graphs
- 28. greedy search
- 29. Wumpus world
- 30. syntax and semantics
- 31. rewrite system
- 32. meta-language
- 33. resolution (syllogism)
- 34. knowledge engineering
- 35. expert system

36. (25 points) A *palindrome* is a word that reads the same in both directions (e.g. *radar*). Write a `PROLOG` problem to find all palindromes of length 4, given a KB with

```
letter(a).  letter(b).  ... letter(z).
word([a,a,r,d,v,a,r,k]).  ... word([z,y,m,u,r,g,y]).
```

Use a **generate and test** method.