**COMP 3710 Artificial Intelligence**

**Fall 2016**

**Final exam**

Student Name: Student Number:

1. (17 marks) Fill in the blanks in each of the followings.
	1. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a representation of the set of all possible choices in a given problem, one or more of which are the solution to the problem.
	2. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ algorithm is an algorithm that, even for the same input, can exhibit different behaviors on different runs, as opposed to a deterministic algorithm.
	3. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a rule or other piece of information that is used to make methods such as search more efficient or effective.
	4. An \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ algorithm expands paths from nodes that have the lowest f-value until the algorithm visits the goal node.
	5. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ problem is a combinatorial optimization problem with a set of constraints.
	6. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ algorithms are based on biological evolution.
	7. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a genetic operator used to vary the programming of a chromosome or chromosomes from one generation to the next.
	8. A \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a sentence that is true of false but not both.
	9. An argument is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if its conclusions follow logically from its premises, even if the argument does not actually reflect the real world.
	10. In Boolean logic, a formula is in \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ if it is a conjunction of clauses, where a clause is a disjunction of literals.
	11. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are designed to solve complex problems by reasoning about knowledge, represented by mainly as if-then rules.
	12. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is an inference method that can be described as working backward from the goal(s).
	13. For a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, every value in the universe of discourse has a membership value, and so is a member to some extent.
	14. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the problem of identifying to which of a set of classes a new observation belongs, on the basis of a training set of data containing observations (or instances) whose class membership is known.
	15. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is the task of grouping a set of objects in such a way that objects in the same group are more similar (in some sense or another) to each other than to those in other groups.
	16. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ learning learns by being presented with pre-classified training data set.
	17. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ behavior can appear when a number of simple entities operate in an environment, forming more complex behaviors as a collective.
2. (2 marks) Explain what an admissible heuristic is.
3. (5 marks) Fill in the blanks in each of the followings
	1. *P*(*A* ∨ *B*) = \_\_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_\_ - \_\_\_\_\_\_\_\_\_\_
	2. *P*(*A*) = *P*(*A* ∧ *B*) + \_\_\_\_\_\_\_\_\_\_
	3. *P*(*A* ∧ *B*) = *P*(*A*) \* \_\_\_\_\_\_\_\_\_\_
	4. *P*(*A* | *B*) = 1 - \_\_\_\_\_\_\_\_\_\_
	5. *P*(*A* ∧ *B* | *C*) = \_\_\_\_\_\_\_\_\_\_ \* \_\_\_\_\_\_\_\_\_\_, where *A* and *B* are conditionally independent given *C*.
4. (3 marks) Find *P*(~*cavity* | ~*toothache*) from the following joint probability table.



1. (3 marks) Let *M* be meningitis, *S* be stiff neck. The stiff neck is one symptom of meningitis. What is the probability of having meningitis with stiff neck, assuming the following probabilities?

*P*(*S*) = 0.2; *P*(*M*) = 0.0001; *P*(*S*|*M*) = 0.8

1. (4 marks) From the following Bayesian network, what is the probability that Mary does not call, alarm is not ringing, and there is no burglary?



1. (4 marks) Find the class to which (3, 2, 2) belongs from the following training data. You should show how you find the class.

