Quiz 1 Answer Key

Question Number	Question	Correct Answer	Marks
1	Untitled	Answer Key 1. Assume P→ Q (S1 is true) [0.5 pts] 2. Assume R→ ¬Q (S2 is true) [0.5 pts] 3. Q→ ¬R (Modus Tollens) [1 pts] 4. P→ ¬R (**Hypothetical Syllogism on step-1 and step-3) [2 pts]** **5. S3 is true (S3 is same as step-4) [1 pts]** **6. S2→ S3 (Whenever S2 is true, S3 is true) [0.5 pts]** **7. S1→S4 (Step-6 is same as S4, and whenever S1 is true, S4 is true) [0.5 pts]** **Marking scheme** **Partial points awarded based on scheme above** **0 points for truth table based solutions** **Any other logically consistent solutions will be awarded points (Simplifying to AND and OR and applying De-Morgan's laws, if such solutions exist)**	6
2	Untitled	Answer Key 1. ¬(¬P ∨ (Q ∧ R)) (Remove the implication) [2 pts] 2. ¬(¬P) ∧ ¬(Q ∧ R) (Using De Morgan Laws) [2 pts] 3. P ∧ (¬Q ∨ ¬R) (Double negation and De Morgan's laws) [2 pts] Marking scheme 1. Full marks for any solution that arrives at the final answer as long as it is logically consistent and it is equivalent to the answer at step-3 and in CNF and simplified (1 mark deducted if there is double negation)	6

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		2 . Any other incorrect solution will be awarded partial marks based on the scheme in the answer key.	
3	Untitled	A) A logic is decidable if there is a mechanical procedure (computer program) / decision procedure that always terminates and can decide whether a given consequence (theorem) is provable. (2 marks) B) 1. It consists only of propositional constants that can take values of true/false and boolean connectives (2 marks) 2. Given any consequence, one can always convert it into truth table with finite propositional constants.(1 mark) 3. For n propositional constants, there are at most 2^n rows in the truth table, hence one can decide provability in finite time. 4. Hence decidable (1 mark) Partial marks awarded based on correctness. Simply writing decidable without correct explanation fetches no marks.	8
4	.	• **1.0 mark** — mentioning Monte Carlo Tree Search (MCTS).- 0.5 given if only Monte Carlo written and Tree not written • **1.5 marks** — MCTS uses a random/probabilistic approach whereas bfs/dfs is deterministic/sequential/fixed order. If only random probabilistic mentioned and not abt bfs/dfs- then 1 mark, if only written in terms of order/sequence and no use of the words random/probabilistic- then 1 mark. • **1 marks** — Any other relevant distinction with its reasoning(for example: exhaustive exploration of every branch versus heuristic approach, explaining time and space complexity between both (not just stating but giving reason why it is so), applicative uses of mcts and bfs/dfs (neural network based/complex alg, etc). Just stating time complexity is lesser in mcts than bfs/dfs without any reasoning or explanation gives 0.5 marks. just reiterating the first difference of probabilistic approach is not	4

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		considered as a second difference (exact explanation of how the method works, relies on previous paths etc without explaining how bfs/dfs is diff gives 0.5). - 0.5 marks- ideally while explaining the above answer one difference in the way bfs and dfs traverses must be mentioned to explain how mcts is different. Any one relevant difference between bfs/dfs like (layer by layer vs recursive/goes till leaf node) is considered. For those who wrote only difference between bfs/dfs and not with mcts 0.5 is given. **Note:** Award **0.5 marks** if either difference is not clear; award the complete **marks** when the explanation is mostly correct and not vague	
5	☑ Untitled	**a) What is underfitting?** • **1 mark** — writing any one of: - Model performs bad on both train and test - High bias, low variance - Consistent but in a bad way **b) Example** • **0.5 marks** — valid train set with both inputs and outputs • **0.5 marks** — valid test set with both inputs and outputs (if not part of the same distribution as train set, true function has to be provided) • **1 mark** — valid function that underfits the data (has to be something that the model could possibly learn from the training data, i.e. can't give a function with random coefficients) **c) Why underfit?** Either: • **1 mark** — bias calculation • **1 mark** — variance calculation • **1 mark** — explanation of calculation results (high bias, low variance) or: • **1 mark** — bias calculation on train set	6

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		• **1 mark** — bias calculation on test set • **1 mark** — explanation of calculation results (high bias, minimal difference between both biases) If functions, points, and explanation are given pictorially using a plot, only half of the marks can be given (e.g. 0.5 for high bias explanation) — max of **1.5 marks** for (c) if shown pictorially	