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Instructions: Each question is worth the given amount of points, and the whole quiz is worth nine points in total. Answer each question to the best of your ability. Read all instructions carefully. Submit your quiz to eClass before **Wednesday** at 11am. You may submit your quiz as a pdf, a docx, or as a zip file of images. **It is your responsibility to ensure the TAs and instructor can read your answers**, if you’re concerned about that please type your answers.

**Multiple Choice (0.5 points each)**. Circle the answer closest to the one you would give.

**Q1 (0.5 points).** Which of these best describes the high-level concept of a “neurosymbolic” approach?

(A.) Representing neurons in a symbolic representation

**(B.)** Using a symbolic AI approach (planning, grammar, etc.) to guide a neural generator

(C.) Generating symbols such as text with a neural generator

(D.) Using neural networks where otherwise you’d use a symbolic AI approach

**Q2 (0.5 points).** Which of the following is an accurate descriptor of a Markov Decision Process (MDP) component?

(A.) The **Reward** **(R)** is what an agent gets after it “solves” the MDP.

(B.) The **State (S)** is where you solve the MDP.

(C.) The **Transition function (T)** is the probability of transitioning to another MDP.

**(D.)** The State (S) is one moment in space/time where our agent can take an action.

**Q3 (0.5 points).** Let’s say we want an AI agent to play a card game that includes hidden information. The card game is 1v1, where each player has a hand of 5 cards. Let’s say there’s 4 colours of cards (red, yellow, blue, and white), with 10 of each in the deck. At a particular point in the game there are 10 cards on the board (visible to both players and distinct from the cards in both players’ hands): 5 red, 3 yellow, and 2 blue cards. The opponent played the 5 red cards, and the AI played the rest. In the AI’s hand it has 3 blue cards, and 2 yellow cards. Which of these most closely represent the most likely AI belief (the midpoint of the Gaussian) of the opponent’s hand?

a/c

**(A.)** The opponent has 5 white cards

(B.) The opponent has 5 red cards

(C.) The opponent has a mix of cards, with the majority likely to be white cards

(D.) The opponent has a mix of cards, with no card colour being more likely than any other

**Q4 (3 points**). Choose 3 pairs from the 9 AI-based game design patterns identified by Treanor et al., as a reminder they are: (1) AI is Visualized, (2) AI is Role-model, (3) AI as Trainee, (4) AI is Editable, (5) AI is Guided, (6) AI as Co-creator, (7) AI as Adversary, (8) AI as Villain, and (9) AI as Spectacle. Then for each of the 3 pairs:

(A) Give me the pair

(B) Give me a brief description of what kind of game would have this pair of patterns in terms of the game’s AI.

(C) Describe what techniques discussed throughout the semester you would use to implement each of the games and why. You’ll receive **1 point** for each game where you’ve identified whatAI techniques would be *appropriate* to implement that pattern(they don’t have to be the best, as long as you give a good reason why they’d be appropriate).

So, you’ll answer parts A, B, and C three times. Label the games “Game 1”, “Game 2”, and “Game 3”.

**Game 1**

1. **AI is Trainee and AI is Villain**
2. **A horror game wherein the AI learns from the techniques the players use(in this case I assume techniques being items used) and adjusts playstyle.**
3. **Behaviour Tree’s would be very effective here as we can set various flags that if raised/not used/not in inventory, change the behaviours and transition to other sequences or priority queues.**

**Game 2**

1. **AI is Editable and AI is visualized**
2. **A survival game where the AI must live in a small world by gathering materials, hunting and building in this world. Visualized is important because we need to see where they will go to and what they plan on gathering so we can edit it to edit something else.**
3. **One technique that could be good here would be Backward Planning. This is because that we aim to survive by having shelter and food, so we can set an arbitrary number of food/materials we need to gather alongside the player as a goal we need to achieve and reach and use A\* to plan its path to get resources the fastest.**

**Game 3**

1. **AI is Co-creator and AI is Spectacle**
2. **A game that could you that is a game which produced artwork, whether it be pictures, art or sculptures. AI is a co-creator would work in the way that the player can give the AI a word prompt to work off of whereas AI is Spectacle would be used as the Player would not need to play the game and just watch the AI create something whether is close to the prompt or wildly different.**
3. **One technique that could prove effective in using AI is a co-creator is using Grammars that could match the prompt. We could write out a list of rules and grammars that the AI could check and pick out the tokens that are the closest to the prompt**

Q5 **(1.5 points).** For your 3 games from question 3, what automated game playing approach would be the best to use (0.5 points each)? **Make sure to include 1-2 sentences on why it would be the best.**

1. **An approach that I could use for game 1 is Reinforced Learning. This is because our game is relatively large in scope and because we want our enemy AI to adapt to various different scenarios and evolve as the game goes on, we can give it a lot of training data to be able to adapt to the scenarios better and cause less funky behaviour.**
2. **An approach that I could use for game 2 is Planning. This is because we have goals we need to satisfy(Food/Materials) and we have a small game state space with all the information available to us so we would rather use planning to be able to achieve our goals more effectively.**
3. **An approach that I could use for game 3 is Reinforced Learning. This is because if we train the AI with a lot of different possible data, the closer the output matches the prompt inputted which leads to less weird/confusing outputs.**

**Q6 (2 points).** Answer the following parts to the best of your ability.

**Q6.A (0.5 points)**.

Write five dialogue rules of a grammar-based chatbot for a non-player character (NPC). Assume you have the following tokens:

* <PN> which is replaced by the player’s name
* <LQ> which is replaced by the last quest the player finished
* <LR> which is replaced by the player’s last line of dialogue
* <CR> which is replaced by the player’s relationship with this NPC (e.g. friend, enemy, etc.)
* <LB> which is replaced by the last boss the player defeated

You can assume we have access to any information you want, and you can make up any variables you want. Write the rules in an “if [blank] then say [text]” format in plain text except the use of the tokens. **Each rule should make use of at least one token, and one rule must make of at least two tokens. Further, you must use each token at least once.** For example:

1. If the player’s previous dialogue included “hello” and we’ve met the player then say “Hello <PN>!”

2. If the player’s previous dialogue included “quest” and “difficult” say “Was <LQ> difficult?”

3. If the player’s previous dialogue included “thanks” say “Anything for my <CR>”.

4. If the player hasn’t been seen in a while say “Oh hi <PN>! I heard you defeated <LB>! Nicely done!”

5. If the player’s previous dialogue does not match any other rules say, “What do you mean by <LR>?”

Do not have any rule that can be thought of as equivalent to these five in terms of conditions and effect.

1. **If players previous dialogue has “boss” included and we have not met the player, then say “Are you the great <PN> who defeated <LB>?!”**
2. **If players previous dialogue has the word “ally” and “you”, then say “You too are my <CR>”**
3. **If players previous dialogue has “quest” and “clear” included and player has met guild-master, then say “Thank you for clearing the <LQ> Quest, the guild-master is so happy you took care of that nuisance!”**
4. **If players previous dialogue has “idiot” in dialogue, then say “Says the idiot who 5 seconds ago said <LR>!”**
5. **If player has a home and their HP or MP is below 10% and has included the word “tired” or “painful”, then say “Go home <PR> and get some rest!”.**

**Q6.B (1.5 points)**. Given your rules from Q6.A, give three different examples or situations (0.5 points each) using three of the five rules where an NPC would say something odd or that didn’t match the designer’s intention. For example, the NPC might say “Hello you weirdo!” using my example rule 1 if the player named themselves “you weirdo”. However, you may not have all three of your examples be fundamentally the same (i.e. don’t just use a weird player name three times). Yes, that means you can use a weird player name for one of your three answers.

Make any assumptions about the game, NPC, dialogue system, or player, but state them. You may assume these scenarios occur for three different players if you want.

**Scenario 1: Player Name=Duck, Last Boss = Happiness 🡪 Are you the great Duck who defeated Happiness?!**

**Scenario 2: Players has had their best friend die last and the dialogue was “I can’t believe that idiot died, he was my best friend” 🡪 “Says the idiot who 5 seconds ago said “ I can’t believe that idiot died, he was my best friend**

**Scenario 3, Player completed a quest in which they had to kill the guild-master. Dialogue could be like “That last quest was tough to clear” 🡪 “Thank you for clearing the Kill the Guild-master quest, the guild-master is so happy you took care of that nuisance!”**

**Q7** (**1 point**). We covered many topics this term, and not all of them had an assignment dedicated to them. Pick a topic/technique covered in a lecture anytime this semester and give me a high-level description (2-4 sentences) of what an assignment for that topic/technique in the Pacman environment could look like.

**Behavior Tree would be my choice. The assignment could be like he person has to implement Behaviour Tree for a certain number of Ghosts(2-3). Similar to the FSM assignment we could have one that is nearly completed and then they would have to create custom Ghost from scratch. They would have to make use of a sequence and at least 2+ Priority Queues. They could decide on what variables will they need to check (i.e. Power Pellet eaten, number of pellets) and must have transitions working from one Priority Queue to the Other.**

**Extra Credit (1 point).** If you could have any kind of AI (in a game or otherwise), what would you want? How might it work? This isn’ta trick question, just a fun final extra credit, but you need to give both your ideal AI and some notion of what AI techniques could make it possible for the full point.

**An AI that can help players improve in various PvP/RTS games by making the player think of various different strategies/matchups to play against this AI that will employ. Reinforced Learning & Neural Networks can help with this (will require an extreme amount of computational power) by using training data and analyzing those data to help this AI learn and adapt.**