Computational Intelligence
Final Quiz

QUIZ ANSWERS

Answer the questions in the spaces provided. If you run out of room for an answer, continue on the back of the page.

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1. What is the first thing you should do when faced with a problem potentially solvable with CI [1].

   - ○ Gather test data
   - ◉ Determine size of search space   (I'D ACCEPT THIS TOO)
   - ○ Pick method, i.e. PSO, NN's, etc.
   - ○ Change careers
   - ○ Determine fitness function
   - ● Set the goal and accuracy required
   - ○ None of the above

2. What is the second thing you should do when faced with a problem potentially solvable with CI.
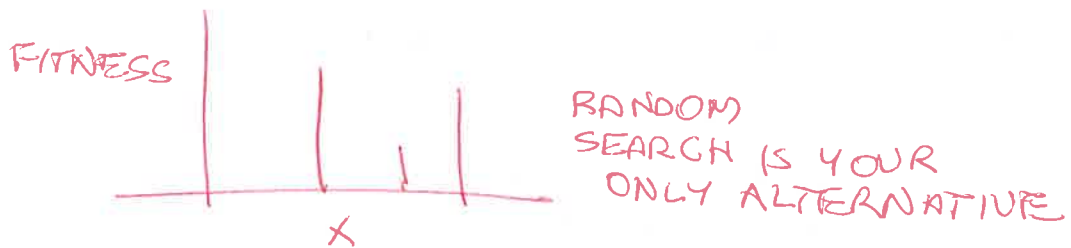
   - ○ Gather test data
   - ● Determine size of search space
   - ○ Pick method, i.e. PSO, NN's, etc.
   - ○ Ask your mother
   - ○ Determine fitness function
   - ○ Set the goal and accuracy required
   - ○ None of the above

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[1] Computational Intelligence

3. Sketch a benign one dimensional search space. The x-axis is the independent variable and the y value is the fitness.

FITNESS

THIS YOU CAN HILL CLIMB

X
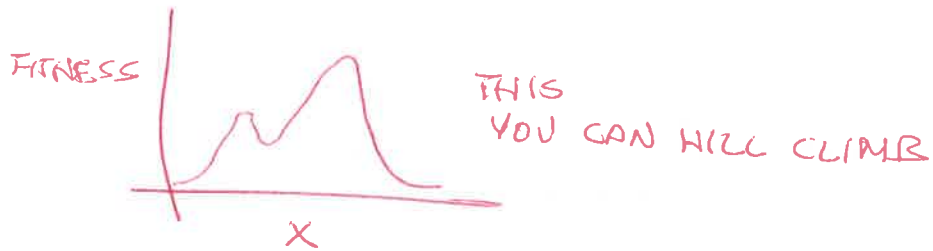
4. Sketch an evil one dimensional search space. The x-axis is the independent variable and the y value is the fitness.

FITNESS

RANDOM SEARCH IS YOUR ONLY ALTERNATIVE

X

5. Describe the representation used by each of the following,

(a) NN

HIERARCHICAL STRUCTURE OF NEURONS AND WEIGHTS

(b) GP

ROOTED ORDERED TREE WITH FUNCTIONS & TERMINALS

(c) GA

BITSTRING

(d) EC

ANYTHING, YOU PICK   i.e. HP STACK COMP'R

(e) PSO

ARRAY OF FLOATS OR BITS


(f) FSM

STATES
TRANSITIONS
INPUTS/OUTPUTS

(NOT REALLY AN EC TECHNIQUE BY ITSELF)

6. The non-straw end of a broom is placed on an x-y carriage with the straw end of the broom above it. The x-y carriage should move appropriately to keep the broom approximately vertical.

(a) What would the fitness function be for this CI broom balancer?

· HOW LONG BEFORE BROOM FALLS DOWN
· OTHER FF's ARE POSSIBLE ..

(b) How would you compute the chosen fitness function?

YOU NEED TO BUILD A PHYSICS ENGINE!

$$W_b$$
$$\theta_b \longrightarrow \boxed{P.E.} \longrightarrow NEW \ (W_b', \theta_b') \ldots$$
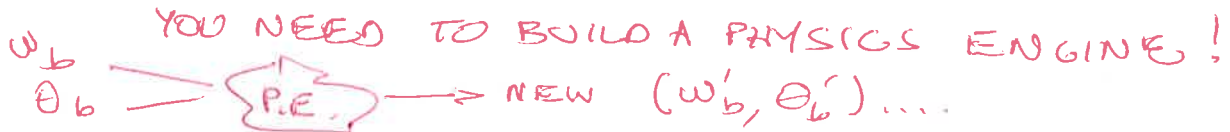
7. Given the neural network below. If you were using PSO to train this network what would the representation be?

Neural Network

8 weights

W_1 W_3 W_2 W_7 W_4 W_5 W_8 W_6

Input   Hidden   Output
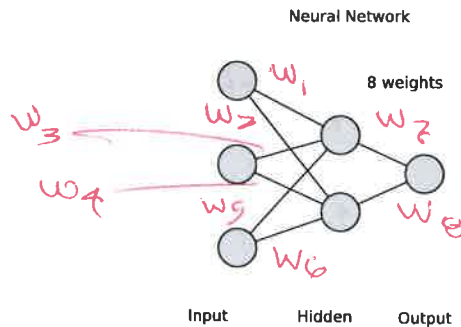
PSO IS ARRAY OF FLOATS, HERE THE WEIGHTS ARE A POSSIBLE SOLUTION

| W_1 | W_2 | W_3 | W_4 | W_5 | W_6 | W_7 | W_8 |

8. You want to predict tomorrow's stock market DOW with a neural network (simply whether it goes up or down) using the previous 3 days DOW closing price. Please sketch an appropriate potential neural network topology.

PRICES { DAY -1 / DAY -2 / DAY -3
COULD BE ANY # OF NEURONS
TO DAY

Extra Credit
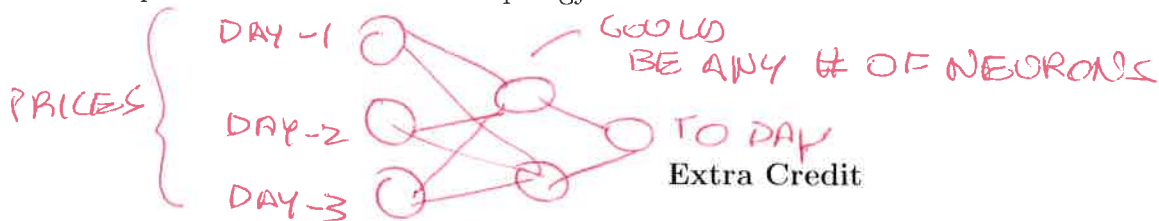
9. You want to design a CI system for recognizing Bach music (I find it generally has a unique character to it)

① THIS IS NOT EASY.....
② PERHAPS ENCODING THE MUSICAL SCORE ,,,,
— THE MP3 FILE IS NOT A GOOD WAY

(a) What CI approach would you use?

NEURAL NETWORKS MIGHT WORK

(b) What would your fitness function be?

$I_1, I_2, I_3 \ldots I_n$ $\begin{matrix} 1 - \text{IF A BACH PIECE} \\ 0 - \text{IF SOMETHING ELSE} \end{matrix}$ I's ARE ENCODED SCORE

(c) If successful, could you use it to help write 'Bach-Like' music? If so, how would you do it?

- GENERATE RANDOM SCORES
- USE YOUR "BACH DETECTOR" NEURAL NETWORK AS A FITNESS FUNCTION
- EVOLVE

ACTUALLY YOU WOULD JUST USE PSO WITH YOUR "BACH DETECTOR" FITNESS FUNCTION.