

COMP 5660/6660 Fall 2021 Exam 3 - Canvas Quiz Key

This is a closed-book, closed-notes exam. The sum of the max points for all the questions is 48, but note that the max exam score will be capped at 46 (i.e., there are 2 bonus points, but you can't score more than 100%). You have exactly 50 minutes to complete this exam. Keep your answers clear and concise while complete. Good luck!

1. A multi-population cooperative CoEA is a CoEA where: [4 pts]

- (a) each population tries to solve its own problem without harming the fitness of any of the other populations
- (b) the populations are symbiotic species
- (c) each population is a different species representing part of a larger problem

Select one of:

- a [2]
- b [2]
- c [2]
- a and b [3]
- a and c [3]
- b and c [3]
- **all of a, b, and c**
- none of a, b, nor c [0]

2. In the context of two-population competitive coevolution, a CIAO plot: [4 pts]

- (a) visualizes the progress of the two populations where the luminance of each pixel (x, y) indicates the relative performance of the y -axis population's fittest individual in generation y versus the x -axis population's fittest individual in generation x
- (b) visualizes the relative performance of two populations where the luminance of each pixel (x, y) indicates the average performance of individual y from the y -axis population versus all its ancestors fittest opponents
- (c) visualizes the relative performance of the two populations where the luminance of each pixel (x, y) indicates the current best fitness from the x -axis population at generation x divided by the current best fitness from the y -axis population at generation y
- (d) allows the visual comparison of two different coevolutionary runs by comparing the populations from the final generation of each run
- (e) isn't a plot, "ciao" is Italian for "hello"

Select one of:

- **a**
- b [2]
- c [1]
- d [1]
- e [0]
- none of a, b, c, d, nor e [0]

3. Your Assignment 2c Pac-Man versus maps base problem: [4 pts]

- (a) is technically not a competitive coevolution problem because Pac-Man controllers and maps are different species, so compete in different niches
- (b) is technically not a competitive coevolution problem because they cooperate to find the fittest pairing of a Pac-Man controller and a map
- (c) is technically not a competitive coevolution problem because Pac-Man's adversaries, the Ghosts, are not being evolved

Select one of:

- a [1]
- b [0]
- c [0]
- a and b [0]
- a and c [0]
- b and c [0]
- all of a, b, and c [0]
- **none of a, b, nor c**

4. What is the motivation for the automated design of crossover operators for EAs employing self-adaptation: [4 pts]

- (a) EA performance is sensitive to the choice of crossover operator
- (b) identifying & configuring best traditional crossover operator is time consuming
- (c) existing crossover operators may be suboptimal for the problem at hand
- (d) the optimal crossover operator may change during evolution

Select one of:

- a [1]
- b [1]
- c [1]
- d [1]
- a and b [2]
- a and c [2]
- a and d [2]
- b and c [2]
- b and d [2]
- c and d [2]
- a, b, and c [3]
- a, b, and d [3]
- a, c, and d [3]
- b, c, and d [3]
- **all of a, b, c, and d**
- none of a, b, c, nor d [0]

5. Which of the following inherent characteristics of an EA makes it belong to the family of “embarrassingly parallel” algorithms:

- (a) fitness evaluations within a generation can be computed independently
- (b) runs of an EA can be computed independently
- (c) individual fitness evaluations contain independent and parallelizable operations

Select one of:

- a [2]
- b [2]
- c [1]
- **a and b**
- a and c [2]
- b and c [2]
- all of a, b, and c [3]
- none of a, b, nor c [0]

6. Some of the issues Interactive EAs face are: [4 pts]

- (a) human fitness bottleneck (i.e., humans are relatively slow in evaluating trial solutions)
- (b) humans are prone to fatigue and loss of attention
- (c) humans can be inconsistent
- (d) due to the visual and memory limitations of humans, the number of solutions being ranked at any given moment, needs to be kept relatively small

Select one of:

- a [1]
- b [1]
- c [1]
- d [1]
- a and b [2]
- a and c [2]
- a and d [2]
- b and c [2]
- b and d [2]
- c and d [2]
- a, b, and c [3]
- a, b, and d [3]
- a, c, and d [3]
- b, c, and d [3]
- **all of a, b, c, and d**
- none of a, b, c, nor d [0]

7. In the automated design of EAs, encoding the evolutionary process as a directed graph is preferable compared to Koza-style GP trees, because it: [4 pts]

- (a) is easier to code
- (b) has a larger space of representable EAs
- (c) makes bloat impossible
- (d) is a more natural representation for evolutionary cycles

Select one of:

- a [0]
- b [2]
- c [0]
- d [2]
- a and b [1]
- a and c [0]
- a and d [1]
- b and c [1]
- **b and d**
- c and d [1]
- a, b, and c [1]
- a, b, and d [3]
- a, c, and d [1]
- b, c, and d [3]
- a, b, c, and d [2]
- none of a, b, c, nor d [0]

8. Which of the following statements about Supportive Coevolution are true: [4 pts]

- (a) When employing supportive coevolution, the target fitness function only requires one individual per fitness evaluation, where as coevolution requires two or more individuals per fitness function evaluation
- (b) Supportive coevolution can only have a single genotype that must be used for all support individuals
- (c) Supportive coevolution is used to perform self-adaptation
- (d) Supportive coevolution requires a diffusion model to function

Select one of:

- **a**
- b [0]
- c [2]
- d [1]
- a and b [2]
- a and c [3]
- a and d [2]
- b and c [1]
- b and d [1]
- c and d [2]

- a, b, and c [2]
- a, b, and d [1]
- a, c, and d [2]
- b, c, and d [1]
- all of a, b, c, and d [1]
- none of a, b, c, nor d [0]

9. Which of the following statements about transitivity in competitive coevolutionary games are true: [4 pts]

- (a) Tournament-based pairing schemes are ineffective for intransitive games, because eliminated strategies might still be dominant against the champion.
- (b) Raw fitness is meaningless for intransitive games, and needs to be replaced by a surrogate fitness function.
- (c) Competitive fitness sharing is effective for intransitive games, because it rewards strategies specialized to beat otherwise undefeated opponents.
- (d) The Elo rating system is a good choice to model intransitive games, because it predicts winners based on differences in skill ratings.

Select one of:

- a [2]
- b [0]
- c [2]
- d [0]
- a and b [1]
- **a and c**
- a and d [1]
- b and c [1]
- b and d [0]
- c and d [1]
- a, b, and c [3]
- a, b, and d [1]
- a, c, and d [3]
- b, c, and d [1]
- all of a, b, c, and d [2]
- none of a, b, c, nor d [0]

10. The Maelstrom model for competitive coevolution makes use of adversarial islands that: [4 pts]

- (a) perform interactive asymmetric coevolution
- (b) distribute individuals within a population about a geometry for localized evolution
- (c) generate relative fitness estimates against the local populations

Select one of:

- a [2]
- b [0]
- c [2]

- a and b [1]
- **a and c**
- b and c [1]
- all of a, b, and c [3]
- none of a, b, nor c [0]

11. Assuming a simple genetic algorithm whose global optimum has a fitness of 100.0 and given the following bit strings v_1 through v_5 and schema S

$$v_1 = (10110110011001) \text{ fitness}(v_1) = 1.0$$

$$v_2 = (10110110011001) \text{ fitness}(v_2) = 1.0$$

$$v_3 = (10110110011001) \text{ fitness}(v_3) = 1.0$$

$$v_4 = (10110110011001) \text{ fitness}(v_4) = 1.0$$

$$v_5 = (10110110011001) \text{ fitness}(v_5) = 1.0$$

$$S = (10110110011001)$$

- (a) Compute the *order* of S . [1] 14
- (b) Compute the *defining length* of S and show your computation. [1] $14-1=13$
- (c) Compute the fitness of S and show your computation. [1] $\frac{1.0+1.0+1.0+1.0+1.0}{5} = 1.0$
- (d) Do you expect the number of strings matching S to increase or decrease in subsequent generations? Explain your answer! [5]

While S matches all current strings and recombination alone will therefore not cause any disruption, any mutation of an offspring will create an individual not matching S and considering the relatively low fitness of S versus the global optimum's fitness, it is very likely for mutation to create offspring with higher fitness than S which will result in the number of strings matching S to decrease.