COMP 5660/6660/6666 Fall 2020 Exam 3 - Canvas Quiz Key

This is a closed-book, closed-notes exam. The sum of the max points for all the questions is 62, but note that the max exam score will be capped at 60 (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. In Learning Classifier Systems (LCS), the Bucket Brigade algorithm is a: [4 pts]

   (a) multi-step credit allocation method to distribute reward to members of previous action sets
   (b) multi-step credit allocation method to distribute reward to members of previous match sets
   (c) multi-step credit allocation method to distribute reward to individuals of previous populations
   (d) LCS for optimizing human chain formation to pass buckets of water to put out fires

   Select one of:

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

2. "Intelligent" initialization in a memetic algorithm can be performed by: [4 pts]

   (a) Seeding
   (b) Selective Initialization
   (c) Locally Optimized Random Initialization
   (d) Mass Mutation

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

3. The Baldwin Effect is: [4 pts]

   (a) improved EA performance obtained by applying local search prior to fitness calculation
   (b) improved EA performance obtained by applying local search after fitness calculation [1]
   (c) improved EA performance obtained by combining local search with Lamarckian evolution [$\frac{1}{2}$]

   Select one of:

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

4. A Competitive Coevolutionary Algorithm is a CoEA: [4 pts]

   (a) with two or more competing populations
   (b) where each individual competes with one or more individuals in the competing population
   (c) where individuals compete with each other to gain fitness at each others expense

   Select one of:

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

5. Mediocre stability in a competitive CoEA occurs when: [4 pts]

   (a) the convergence of the system is not very stable
   (b) the system stabilizes in a suboptimal equilibrium
   (c) cycling causes instability in the system

   Select one of:

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

6. Your Assignment 2c Ms. Pac-Man versus The Ghosts problem: [4 pts]

   (a) is technically not a competitive coevolution problem because it is a single population problem

   (b) is technically not a competitive coevolution problem because it is a single species problem

   (c) is technically not a competitive coevolution problem because the ghosts cooperate with each other

   Select one of:

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

7. A hyper-heuristic is: [4 pts]

   (a) a metaheuristic which searches algorithm space employing algorithmic primitives

   (b) a type of Genetic Programming to automate the design of algorithms employing a Turing complete set of primitives *(it can be a different type of metaheuristic than GP and typically should use higher order primitives than a Turing complete set to avoid an infeasibly large search space)*

   (c) a type of EA which employs algorithmic primitives extracted typically from existing algorithms to automate the design of algorithms *(it can be a different type of metaheuristic than an EA)*

   Select one of:

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

8. In order for a hyper-heuristics to target not only a specific class of problems (e.g., SAT) but also a specific computational architecture (e.g., Intel Xeon processor with lots of cache): [4 pts]

   (a) this is not possible because hyper-heuristics work independent from the computational architecture

   (b) they need to reflect the efficiency of the evolved algorithm in the fitness function

   (c) they need to be supplied with algorithmic primitives which not only are suited to the specific class of problems being targeted, but also allow the differences between computational architectures to be exploited

   Select one of:

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

9. 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]
   - **a, b, c, and d**
   - none of a, b, c, nor d [0]

10. On a computer system with 400 computing cores and given a population size of 200 and an offspring size of 300, employing an Asynchronous Parallel EA (APEA) for evolving GP controllers for Pac-Man: [4 pts]

    (a) may be expected to reduce run-time versus a Synchronous Parallel EA (SPEA) because a SPEA cannot utilize more cores than the offspring size while an APEA can

    (b) may be expected to increase run-time versus a SPEA because an APEA cannot utilize more cores than the population size while a SPEA can

    (c) may be expected to reduce run-time versus a SPEA because a SPEA has to wait for the longest evaluation to complete while an APEA can exploit the heterogeneous evaluation times common to GP

    Select one of:

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

11. Some of the advantages of Interactive EAs are: [4 pts]

    (a) handling situations with no clear fitness function

    (b) handing situations with changeable objectives and preferences

    (c) improved search ability through the user changing their guiding principle

    (d) increased exploration and diversity through direct user manipulation of the system

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

12. Given the following bit strings v_1 through v_5 and schema S
$v_1 = (11101110111101)$ $fitness(v_1) = 0.3$
$v_2 = (10110010001101)$ $fitness(v_2) = 0.1$
$v_3 = (00001010011010)$ $fitness(v_3) = 1.0$
$v_4 = (01001110111001)$ $fitness(v_4) = 1.9$
$v_5 = (11001011110101)$ $fitness(v_5) = 1.7$
$S = (00000001111111)$

    (a) Compute the *order* of S. [2 pts]
    14

    (b) Compute the *defining length* of S and show your computation. [2 pts]
    14-1=13

    (c) Compute the fitness of S and justify your answer. [2 pts]
    Undefined because S doesn't match any of the given strings.

    (d) Do you expect the number of strings matching S to increase or decrease in subsequent generations? Explain your answer! [4 pts]
    Because S currently doesn't match any strings and eventually may match strings after sufficient recombination and mutation has taken place, the number of strings matching S is expected to eventually increase.

13. The n-bit multiplexer function consist of k address bits a_i followed by 2^k data bits d_j where $n = k + 2^k$ and the function is defined as $a_{k-1}, \ldots, a_1, a_0, d_{2^k-1}, \ldots, d_1, d_0$. Assume a Michigan-style Learning Classifier System (LCS) to solve a 6-bit multiplexer problem with the following rule set:
Rule 1: 1##### : 0 → 50
Rule 2: 11###0 : 0 → 20
Rule 3: 0#1010 : 1 → 10
Rule 4: #11##0 : 1 → 30
Rule 5: #00100 : 0 → 60
Rule 6: ###1#0 : 1 → 50

    If the input string 111100 is presented to this LCS:

    (a) which rules will the match set consist of? [2 pts]
    Rules 1, 2, 4, 6

    (b) which rules will the action set consist of and what action will the LCS execute? Show how you computed this. [6 pts]
    Group them by advocated action and compute predicted action payoff:
    Action 0: Rules 1 & 2: Mean predicted action payoff: (50+20)/2=35
    Action 1: Rules 4 & 6: Mean predicted action payoff: (30+50)/2=40
    Highest predicted payoff action: Action 1
    Action set: Rules 4 & 6
    LCS executes Action 1