CS348 FS2013 Exam 3 Key

This is a closed-book, closed-notes exam. The only items you are allowed to use are writing implements. Mark each sheet of paper you use with your name and the string “cs348fs2013 exam3”. If you are caught cheating, you will receive a zero grade for this exam. The max number of points per question is indicated in square brackets after each question. The sum of the max points for all the questions is 31, but note that the max exam score will be capped at 30 (i.e., there is 1 bonus point but you can’t score more than 100%). You have exactly 75 minutes to complete this exam. Keep your answers clear and concise while complete. Good luck!

Multiple Choice Questions - write the letter of your choice on your answer paper

1. Parameter Control is important in EAs because: [2]
   (a) optimal strategy parameter values may change during evolution [1]
   (b) it may somewhat relieve users from parameter tuning as parameter control may make an EA less sensitive to initial strategy parameter values [1]
   (c) all of the above
   (d) none of the above [0]

2. “Blind Parameter Control” is a better name for the class of parameter control mechanisms named “Deterministic Parameter Control” in the textbook because that class: [2]
   (a) does not use any feedback from the evolutionary process [1]
   (b) includes stochastic mechanisms [1]
   (c) all of the above
   (d) none of the above [0]

3. If we employ self-adaptation to control the value of penalty coefficients for an EA with an evaluation function which includes a penalty function, then: [2]
   (a) this cannot be done because it is inherently impossible to self-adapt any part of the evaluation function [0]
   (b) the penalty coefficients will be self-adapted, but the increase in fitness achieved may not be correlated with better performance on the objective function
   (c) the penalty coefficients will be self-adapted to cause fitness improvement just like, for instance, mutation step sizes [1]
   (d) all of the above [1]
   (e) none of the above [0]

4. Learning Classifier Systems are technically speaking: [2]
   (a) a type of Condition-Action Rule-Based System [1]
   (b) a type of Reinforcement Learning System [1]
   (c) a type of Evolutionary Algorithm [0]
   (d) all three types [1]
   (e) both of the first two types, but not the third
   (f) none of the above [0]
5. The Pitt and Michigan approaches in Learning Classifier Systems differ in that: [2]

(a) in the Pitt approach each individual has the option of either representing a single rule or a rule set, while in the Michigan approach each individual represents a single rule and the entire population represents the complete rule set [1]

(b) in the Pitt approach each individual represents a single rule and the entire population represents the complete rule set, while in the Michigan approach each individual has the option of either representing a single rule or a rule set [1]

(c) in the Pitt approach each individual represents a complete rule set, while in the Michigan approach each individual represents a single rule and the entire population represents the complete rule set

(d) in the Pitt approach each individual represents a single rule and the entire population represents the complete rule set, while in the Michigan approach each individual represents a complete rule set [1]

(e) in the Pitt approach each individual represents a complete rule set, while in the Michigan approach each individual has the option of either representing a single rule or a rule set [1]

(f) none of the above [0]

6. The Limiting Cases in the Greedy Population Sizing EA (GPS-EA) are those instances when: [2]

(a) the larger population is stuck in a local minimum but the average fitness of the smaller population is larger than the average fitness of the larger population [1]

(b) both populations are stuck in a local minimum and the average fitness of the larger population is lower than the average fitness of the smaller population

(c) both populations are stuck in a local minimum and the average fitness of the larger population is higher than the average fitness of the smaller population [1]

(d) none of the above [0]

7. In the hybridization of the GPS-EA and ELOOMS, the Limiting Cases are detected by: [2]

(a) none of the individuals desiring to mate with any other individual [1]

(b) none of the individuals desiring to mate with an individual who reciprocates that desire

(c) the average fitness of the mating pool being higher than the average population fitness [0]

(d) the average fitness of the mating pool being lower than the average population fitness [0]

(e) none of the above [0]

8. A shortcoming of the GPS-EA + ELOOMS hybrid in terms of population size control is: [2]

(a) that it can overshoot the optimal population size because of the stochastic nature of the doubling criterion [1]

(b) its inability to reuse the high-quality individuals identified in preceding populations [1]

(c) the lack of support for dynamic population size control [1]

(d) all of the above

(e) none of the above [0]
9. Dawkin’s concept of a “meme” is: [2]
   (a) the addition of a learning phase to the evolutionary cycle [½]
   (b) a unit of biological transmission [½]
   (c) a unit of cultural transmission
   (d) a process of imitation [½]
   (e) all of the above [½]
   (f) none of the above [0]

10. “Intelligent” initialization in a memetic algorithm can be performed by: [2]
    (a) Seeding [½]
    (b) Selective Initialization [½]
    (c) Locally Optimized Random Initialization [½]
    (d) Mass Mutation [½]
    (e) all of the above
    (f) none of the above [0]

11. The exacerbation of premature convergence in memetic algorithms is due to: [2]
    (a) limited seeding [½]
    (b) diversity preserving recombination operators [0]
    (c) non-duplicating selection operators [0]
    (d) Boltzmann selection [0]
    (e) all of the above [0]
    (f) none of the above

**Regular Questions**

   
   *This is not applicable because per definition all the rules in the action set advocate the same action.*

13. Assuming a simple genetic algorithm whose global optimum has a fitness of 100 and given the following bit strings v₁ through v₅ and schema S
    
    v₁ = (1110110011001)  fitness(v₁) = 19
    v₂ = (1011101101101)  fitness(v₂) = 11
    v₃ = (101101100111)   fitness(v₃) = 2
    v₄ = (1011110011001)  fitness(v₄) = 18
    v₅ = (11111111111)    fitness(v₅) = 10
    S = (001∗01100111∗)

    (a) Compute the order of S. [1]
        
        12
    (b) Compute the defining length of S and show your computation. [1]
        
        13-1=12
    (c) Compute the fitness of S and show your computation. [1]
        
        Undefined
    (d) Do you expect the number of strings matching S to increase or decrease in subsequent generations? Explain your answer! [4]
        
        As S matches none of the current strings, the number cannot decrease, but considering the high order and defining length it is unlikely that any accidental matches in the future will survive, unless they happen to have very high fitness, so increasing seems somewhat tenuous.