Review Question Midterm 1

Applied Genetic and Evolutionary Systems (Concordia University)

Department of Electrical & Computer Engineering (ECE), Concordia University

APPLIED MACHINE LEARNING & EVOLUTIONARY ALGORITHMS

COEN 432 (6321): Fall 23/24

Part 2. Long-Form Questions (for revision)

Q01. What is the general scheme of an evolutionary algorithm (EA)?
Q02. What are variation operators and what role do they play in evolution?
Q02. What is the relationship between exploration and exploitation?
Q03. What is diversity and what is selection pressure, and what is the relationship between them?
Q04. What is the difference between the genotype and phenotype of a candidate solution?
Q05. When does selection operate in an EA?
Q06. What is the typical progression of fitness (mean or best) during an evolutionary run?

Q07. What is a typical binary, integer, real-valued and permutation representation?
Q08. What is 1-point, n-point, uniform crossovers and what kind of bias do they suffer?
Q09. What is uniform, non-uniform and adaptive mutation, and what are the dis/ad-vantages of each?
Q10. Describe different crossover operators applicable to real-valued representations?
Q11. What kind of problems (solutions really) lend themselves to binary, integer, real-valued and permutation representations?
Q12. What are scramble, swap, insert and inversion mutations? How do they affect order and adjacency?
Q13. What are PMX and cycle crossover operators?
Q14. Describe edge crossover.
Q15. What representation is used to represent programs and mathematical expressions? How?

Q16. What is generational vs. steady-state selection and how do you measure generational gap?
Q17. Describe how fitness based selection is applied to a population (with known fitness values)?
Q18. Enumerate the different ways in which fitness can be scaled (e.g., ranking)?
Q19. Describe how tournament selection acts on a population to select parents (with and without replacement)?
Q20. What is the purpose of survivor selection, and what can it be based on?
Q21. List three different methods of fitness-based replacement.
Q22. What is the difference between (mu, lambda) and (mu+lambda) selection?
Q23. What is the key difference between explicit and implicit methods of diversity maintenance?
Q24. What is the difference between genotype and phenotype diversity, and how could you measure each?
Q25. Describe sharing and crowding approaches to diversity maintenance.
Q26. What are the different parameters of the island model? And, what how do cellular EAs work?

Q27. What is the key difference between parameter tuning and parameter control?
Q28. What are the different types of parameter control?
Q29. What quality (or qualities) could we be optimizing when we are searching the parameters' space of an EA?
Q30. What is best/best fitness at termination, average number of evaluations to a solution, success rate, robustness?

Q31. How can we differentiate between relevant and irrelevant parameters?
Q32. What is the main challenge when we are trying to optimize the performance of a EA with symbolic parameters (e.g., a,b,c vs. [0, 100])?
Q33. List 5 different EA parameters that we might want to optimize?
Q34. What are the special features of an evolutionary strategies and what kind of applications would you apply it to?
Q35. What is special about the representation (and hence, variation operators) of evolutionary programming (EP)?
Q36. What kind of problems would you use EP for?
In genetic programming,
Q37. How is a population initialized (ramped half and half: what is it?);
Q38. What are typical mutation and crossover operators?
Q39. Is mutation applied in parallel with or after crossover?
Q40. What is (100-X) type parent selection?
Q41. What is bloat and how could it be reduced?
Q42. What is a classifier? And, how can one evolve a classifier?
Q43. What is the key difference between the Michigan and the Pittsburgh approach to leaning classifier systems (LCSs)?
Q44. Describe the MCS algorithm.
Q45. Can a computer and a human collaborate in evolving an acceptable/optimal solution to a problem? Provide an example.

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