Evolutionary Computing

Exam question examples with answers

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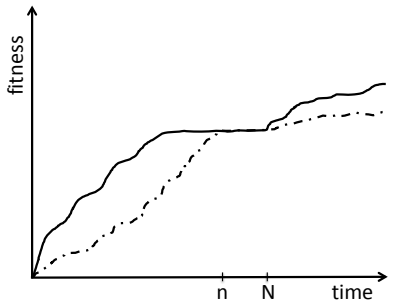
Answers in bold italics.

1. The following picture shows the maximum and average fitness curves of an evolving population. What can we infer regarding the population diversity at generation n?



   A Nothing
   B The first derivative of the diversity curve is zero
   C Diversity must be at its maximum
   D Diversity must be at its minimum
   A

   Note: The population can have different genotypes that all map to the same phenotype.

2. We tackle the n-queens problem with a GA using a bitstring representation where 1 (0) denotes the presence (absence) of a queen on a square. What is the dimensionality of the search space?
   A $2n$
   B $n!$
   C n^2
   D n
   C

3. We want to optimise the function $f(x, y) = x + y$ with Differential Evolution. Consider the following population of 6 individuals:

i	1	2	3	4	5	6
x_i	0.2	0.1	0.4	0.9	0.3	0.7
y_i	0.3	0.1	0.5	0.2	0.8	0.3

   The first step in creating the next generation is the creation of a mutant vector population. What is mutant vector $\overline{v}_4$ if the base vector $\overline{a}_4$ is individual 5, the difference vector

is defined by $\overline{b}_4$ = individual 1 and $\overline{c}_4$ = individual 2, and the scaling factor is $F = 0.5$?

A $\overline{v}_4 = \langle 0.2, 0.5 \rangle$
B $\overline{v}_4 = \langle 0.25, 0.9 \rangle$
C $\overline{v}_4 = \langle 0.35, 0.9 \rangle$
D $\overline{v}_4 = \langle 0.4, 1.0 \rangle$
C

4. What is parameter tuning?

A Parameter tuning is adjusting parameters of the evolutionary algorithm before a run
B Parameter tuning is adjusting parameters of the evolutionary algorithm during a run
C Parameter tuning is adjusting parameters of the evolutionary algorithm during a run based on time
D Parameter tuning is adjusting parameters of the evolutionary algorithm by coding them in the genome
A

5. Determine the truth of statements I, II, and III and select the correct answer from A, B, C, or D.

I Mutation is a unary reproduction operator.

II Crossover is a unary reproduction operator.

III Recombination is an n-ary reproduction operator ($n \geq 2$).

A I and II are true, while III is false
B I is true, II and III are false
C I and III are true, II is false
D All three statements are true
C