Assignment 2 – Part 2

Due date: October 14, 2011
Type your answers and submit a printed hard copy.
Hand-written solutions are not accepted.
Provide the details of your calculation to receive full marks.

1 Diversity Maintenance

The two-dimensional Rosenbrock function is defined as follows:
\[ f(x_1, x_2) = 100 \times (x_1^2 - x_2)^2 + (1 - x_1)^2, \text{ where } -5.0 \leq x_1, x_2 \leq 10.0 \]
The task is to identify its global minimum.

1.1 Fitness Sharing (15 marks)

The current population consists of 5 individuals \((a, b, c, d, e)\). Fill out the following information on the table:

- \(f(i)\) : The fitness of individual \(i\).
- \(f'(i)\) : The shared fitness of individual \(i\), based on \(\alpha = 1, \sigma_{sh} = 1.0\).
- \(p(f)\) : The probability of individual \(i\) to be selected based on the linear-ranking of \(f(i)\) with \(\epsilon = 0.1\).
- \(p(f')\) : The probability of individual \(i\) to be selected based on the linear-ranking of \(f'(i)\) with \(\epsilon = 0.1\).

<table>
<thead>
<tr>
<th>individual ((i))</th>
<th>(x_1)</th>
<th>(x_2)</th>
<th>(f(i))</th>
<th>(f'(i))</th>
<th>(p(f))</th>
<th>(p(f'))</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>-0.8</td>
<td>0.5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>1</td>
<td>1.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c</td>
<td>0.04</td>
<td>-0.12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d</td>
<td>-0.6</td>
<td>-0.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e</td>
<td>0.15</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1.2 Crowding (15 marks)

The current population \( P_t \) consists of the same 5 individuals as that given in question 1.1. The EA uses crowding (CF=5) to update the population after an offspring is generated.

- Give population \( P_{t+1} \) after offspring \((1.3, 1.5)\) has replaced a member of population \( P_t \) (5 marks).

- Give population \( P_{t+2} \) after offspring \((0.9, 1.21)\) has replaced a member of population \( P_{t+1} \) (5 marks).

- Give population \( P_{t+3} \) after offspring \((-0.9, 0.9)\) has replaced a member of population \( P_{t+2} \) (5 marks).