

TABLE S16  
AVERAGED IGD VALUE OBTAINED BY NSGA-II, MOMFEA, EBS, MATEA AND EMATO-MKT OF TASK<sub>1</sub> TO TASK<sub>50</sub> ON WCCI20-MOMATP1 AND WCCI20-MOMATP10 PROBLEMS AFTER 30 INDEPENDENT RUNS, WHERE THE BOLD IS THE BEST RESULT OF ALL ALGORITHMS.

| task            | WCCI20-MOMATP1 |          |          |          |                 | WCCI20-MOMATP10 |          |          |                 |                 |
|-----------------|----------------|----------|----------|----------|-----------------|-----------------|----------|----------|-----------------|-----------------|
|                 | NSGA-II        | MOMFEA   | EBS      | MaTEA    | EMATO-MKT       | NSGA-II         | MOMFEA   | EBS      | MaTEA           | EMATO-MKT       |
| T <sub>1</sub>  | 1.09E-01       | 1.33E-01 | 4.64E+01 | 2.70E-02 | <b>1.60E-04</b> | 1.89E-01        | 2.98E-01 | 1.49E+03 | 5.33E-02        | <b>1.66E-04</b> |
| T <sub>2</sub>  | 8.16E-02       | 1.36E-01 | 4.04E+01 | 2.84E-02 | <b>1.60E-04</b> | 3.73E+01        | 3.37E+02 | 1.91E+07 | 3.22E+01        | <b>3.17E+01</b> |
| T <sub>3</sub>  | 1.04E-01       | 1.46E-01 | 4.49E+01 | 2.88E-02 | <b>1.60E-04</b> | 5.28E-01        | 5.29E-01 | 5.54E-01 | 5.07E-01        | <b>1.95E-04</b> |
| T <sub>4</sub>  | 1.05E-01       | 1.25E-01 | 4.11E+01 | 2.90E-02 | <b>1.59E-04</b> | 2.15E+01        | 1.72E+01 | 3.73E+02 | 2.49E+01        | <b>8.81E+00</b> |
| T <sub>5</sub>  | 1.15E-01       | 1.41E-01 | 4.62E+01 | 2.81E-02 | <b>1.60E-04</b> | 1.14E-02        | 1.79E-02 | 3.99E-01 | 9.84E-03        | <b>2.45E-04</b> |
| T <sub>6</sub>  | 9.83E-02       | 1.28E-01 | 4.55E+01 | 2.46E-02 | <b>1.61E-04</b> | 1.46E+00        | 1.52E+00 | 1.96E+00 | 1.51E+00        | <b>9.71E-01</b> |
| T <sub>7</sub>  | 1.04E-01       | 1.19E-01 | 4.09E+01 | 2.50E-02 | <b>1.60E-04</b> | 1.01E-01        | 2.78E-01 | 1.22E+03 | 5.02E-02        | <b>1.64E-04</b> |
| T <sub>8</sub>  | 9.64E-02       | 1.76E-01 | 5.24E+01 | 2.54E-02 | <b>1.59E-04</b> | 1.30E+02        | 6.79E+01 | 2.38E+07 | <b>2.52E+01</b> | 5.82E+01        |
| T <sub>9</sub>  | 9.16E-02       | 1.40E-01 | 3.83E+01 | 2.48E-02 | <b>1.59E-04</b> | 5.28E-01        | 5.28E-01 | 5.53E-01 | 4.27E-01        | <b>2.12E-04</b> |
| T <sub>10</sub> | 9.20E-02       | 1.44E-01 | 4.51E+01 | 2.21E-02 | <b>1.61E-04</b> | 2.22E+01        | 1.58E+01 | 3.71E+02 | 2.63E+01        | <b>5.69E+00</b> |
| T <sub>11</sub> | 8.86E-02       | 1.41E-01 | 4.46E+01 | 2.55E-02 | <b>1.60E-04</b> | 1.33E-02        | 1.91E-02 | 3.97E-01 | 8.92E-03        | <b>2.15E-04</b> |
| T <sub>12</sub> | 9.68E-02       | 1.49E-01 | 5.44E+01 | 2.80E-02 | <b>1.63E-04</b> | 1.43E+00        | 1.49E+00 | 1.95E+00 | 1.36E+00        | <b>1.06E+00</b> |
| T <sub>13</sub> | 1.11E-01       | 1.34E-01 | 4.29E+01 | 2.41E-02 | <b>1.60E-04</b> | 1.61E-01        | 4.04E-01 | 1.50E+03 | 5.03E-02        | <b>1.63E-04</b> |
| T <sub>14</sub> | 9.94E-02       | 1.38E-01 | 4.05E+01 | 2.60E-02 | <b>1.60E-04</b> | 1.01E+02        | 8.40E+02 | 2.17E+07 | 9.78E+01        | <b>2.85E+01</b> |
| T <sub>15</sub> | 9.14E-02       | 1.37E-01 | 4.53E+01 | 2.60E-02 | <b>1.60E-04</b> | 5.25E-01        | 5.28E-01 | 5.51E-01 | 4.18E-01        | <b>4.31E-04</b> |
| T <sub>16</sub> | 9.68E-02       | 1.49E-01 | 5.44E+01 | 2.68E-02 | <b>1.59E-04</b> | 2.11E+01        | 1.79E+01 | 3.16E+02 | 2.42E+01        | <b>6.67E+00</b> |
| T <sub>17</sub> | 9.08E-02       | 1.29E-01 | 4.90E+01 | 2.58E-02 | <b>1.58E-04</b> | 1.17E-02        | 1.81E-02 | 3.98E-01 | 8.36E-03        | <b>2.06E-04</b> |
| T <sub>18</sub> | 1.12E-01       | 1.42E-01 | 4.89E+01 | 2.54E-02 | <b>1.60E-04</b> | 1.44E+00        | 1.47E+00 | 1.87E+00 | 1.43E+00        | <b>1.01E+00</b> |
| T <sub>19</sub> | 9.85E-02       | 1.53E-01 | 4.39E+01 | 2.94E-02 | <b>1.59E-04</b> | 1.68E-01        | 2.53E-01 | 1.36E+03 | 4.45E-02        | <b>1.65E-04</b> |
| T <sub>20</sub> | 1.03E-01       | 1.34E-01 | 3.86E+01 | 2.33E-02 | <b>1.61E-04</b> | 1.44E+03        | 2.59E+02 | 1.91E+07 | 3.03E+02        | <b>3.97E+00</b> |
| T <sub>21</sub> | 9.86E-02       | 1.37E-01 | 4.75E+01 | 2.73E-02 | <b>1.59E-04</b> | 5.31E-01        | 5.30E-01 | 5.53E-01 | 4.86E-01        | <b>9.79E-04</b> |
| T <sub>22</sub> | 8.63E-02       | 1.20E-01 | 4.08E+01 | 2.68E-02 | <b>1.59E-04</b> | 2.50E+01        | 1.61E+01 | 4.82E+02 | 2.64E+01        | <b>6.70E+00</b> |
| T <sub>23</sub> | 9.88E-02       | 1.44E-01 | 4.96E+01 | 2.29E-02 | <b>1.60E-04</b> | 1.18E-02        | 1.95E-02 | 3.52E-01 | 8.77E-03        | <b>2.11E-04</b> |
| T <sub>24</sub> | 9.66E-02       | 1.40E-01 | 4.19E+01 | 2.48E-02 | <b>1.59E-04</b> | 1.45E+00        | 1.47E+00 | 1.84E+00 | 1.42E+00        | <b>1.01E+00</b> |
| T <sub>25</sub> | 9.01E-02       | 1.49E-01 | 5.24E+01 | 2.93E-02 | <b>1.61E-04</b> | 1.43E-01        | 3.64E-01 | 1.50E+03 | 4.89E-02        | <b>1.65E-04</b> |
| T <sub>26</sub> | 9.99E-02       | 1.23E-01 | 4.32E+01 | 2.59E-02 | <b>1.61E-04</b> | 1.27E+02        | 1.69E+02 | 1.91E+07 | 5.41E+01        | <b>3.10E+00</b> |
| T <sub>27</sub> | 8.66E-02       | 1.30E-01 | 3.57E+01 | 2.50E-02 | <b>1.61E-04</b> | 5.35E-01        | 5.29E-01 | 5.53E-01 | 4.78E-01        | <b>2.08E-03</b> |
| T <sub>28</sub> | 9.75E-02       | 1.54E-01 | 5.16E+01 | 2.67E-02 | <b>1.61E-04</b> | 2.32E+01        | 1.62E+01 | 3.40E+02 | 2.49E+01        | <b>5.89E+00</b> |
| T <sub>29</sub> | 1.04E-01       | 1.44E-01 | 4.44E+01 | 2.44E-02 | <b>1.61E-04</b> | 1.19E-02        | 1.94E-02 | 4.27E-01 | 9.52E-03        | <b>2.29E-04</b> |
| T <sub>30</sub> | 8.20E-02       | 1.41E-01 | 5.07E+01 | 2.70E-02 | <b>1.61E-04</b> | 1.38E+00        | 1.50E+00 | 1.81E+00 | 1.33E+00        | <b>9.79E-01</b> |
| T <sub>31</sub> | 1.01E-01       | 1.34E-01 | 4.59E+01 | 2.95E-02 | <b>1.61E-04</b> | 1.36E-01        | 3.36E-01 | 1.31E+03 | 4.55E-02        | <b>1.65E-04</b> |
| T <sub>32</sub> | 8.17E-02       | 1.42E-01 | 5.17E+01 | 2.53E-02 | <b>1.62E-04</b> | 6.58E+01        | 1.03E+02 | 3.49E+07 | 3.62E+01        | <b>2.50E+01</b> |
| T <sub>33</sub> | 9.76E-02       | 1.38E-01 | 4.74E+01 | 2.43E-02 | <b>1.61E-04</b> | 5.32E-01        | 5.30E-01 | 5.55E-01 | 4.22E-01        | <b>3.27E-03</b> |
| T <sub>34</sub> | 9.43E-02       | 1.33E-01 | 4.59E+01 | 2.57E-02 | <b>1.58E-04</b> | 1.98E+01        | 1.56E+01 | 3.84E+02 | 1.95E+01        | <b>5.41E+00</b> |
| T <sub>35</sub> | 9.26E-02       | 1.41E-01 | 4.12E+01 | 2.22E-02 | <b>1.61E-04</b> | 1.14E-02        | 1.84E-02 | 3.93E-01 | 8.52E-03        | <b>2.10E-04</b> |
| T <sub>36</sub> | 9.28E-02       | 1.19E-01 | 4.26E+01 | 2.47E-02 | <b>1.62E-04</b> | 1.36E+00        | 1.38E+00 | 1.83E+00 | 1.42E+00        | <b>8.50E-01</b> |
| T <sub>37</sub> | 1.08E-01       | 1.36E-01 | 4.70E+01 | 2.49E-02 | <b>1.63E-04</b> | 1.36E-01        | 2.99E-01 | 1.30E+03 | 5.41E-02        | <b>1.65E-04</b> |
| T <sub>38</sub> | 8.88E-02       | 1.46E-01 | 4.39E+01 | 2.97E-02 | <b>1.61E-04</b> | 5.02E+01        | 9.68E+01 | 2.36E+07 | 8.34E+01        | <b>2.98E+00</b> |
| T <sub>39</sub> | 9.07E-02       | 1.26E-01 | 3.94E+01 | 2.30E-02 | <b>1.60E-04</b> | 5.33E-01        | 5.28E-01 | 5.55E-01 | 4.73E-01        | <b>3.73E-03</b> |
| T <sub>40</sub> | 1.15E-01       | 1.29E-01 | 4.42E+01 | 2.50E-02 | <b>1.59E-04</b> | 2.16E+01        | 1.43E+01 | 3.33E+02 | 2.64E+01        | <b>5.01E+00</b> |
| T <sub>41</sub> | 9.60E-02       | 1.36E-01 | 4.82E+01 | 2.78E-02 | <b>1.61E-04</b> | 1.11E-02        | 1.91E-02 | 3.42E-01 | 8.96E-03        | <b>2.55E-04</b> |
| T <sub>42</sub> | 9.60E-02       | 1.50E-01 | 4.45E+01 | 2.81E-02 | <b>1.60E-04</b> | 1.39E+00        | 1.42E+00 | 1.97E+00 | 1.42E+00        | <b>1.02E+00</b> |
| T <sub>43</sub> | 9.55E-02       | 1.32E-01 | 4.03E+01 | 2.53E-02 | <b>1.61E-04</b> | 1.68E-01        | 3.90E-01 | 1.63E+03 | 5.76E-02        | <b>1.64E-04</b> |
| T <sub>44</sub> | 1.05E-01       | 1.21E-01 | 4.33E+01 | 2.44E-02 | <b>1.60E-04</b> | 1.90E+02        | 1.31E+02 | 2.06E+07 | 8.84E+01        | <b>3.67E+00</b> |
| T <sub>45</sub> | 9.52E-02       | 1.50E-01 | 4.13E+01 | 2.54E-02 | <b>1.60E-04</b> | 5.35E-01        | 5.33E-01 | 5.54E-01 | 5.12E-01        | <b>3.18E-04</b> |
| T <sub>46</sub> | 8.97E-02       | 1.54E-01 | 4.22E+01 | 2.88E-02 | <b>1.62E-04</b> | 2.61E+01        | 1.57E+01 | 4.58E+02 | 2.73E+01        | <b>7.84E+00</b> |
| T <sub>47</sub> | 9.85E-02       | 1.37E-01 | 4.51E+01 | 2.50E-02 | <b>1.61E-04</b> | 1.13E-02        | 1.83E-02 | 4.37E-01 | 9.43E-03        | <b>2.10E-04</b> |
| T <sub>48</sub> | 9.95E-02       | 1.28E-01 | 4.18E+01 | 2.79E-02 | <b>1.59E-04</b> | 1.45E+00        | 1.50E+00 | 1.93E+00 | 1.39E+00        | <b>1.03E+00</b> |
| T <sub>49</sub> | 9.93E-02       | 1.33E-01 | 4.44E+01 | 2.44E-02 | <b>1.61E-04</b> | 1.43E-01        | 2.96E-01 | 1.33E+03 | 5.43E-02        | <b>1.65E-04</b> |
| T <sub>50</sub> | 9.30E-02       | 1.50E-01 | 4.45E+01 | 2.19E-02 | <b>1.60E-04</b> | 4.95E+01        | 1.06E+02 | 1.35E+07 | <b>3.37E+01</b> | 4.52E+01        |

TABLE S17  
AVERAGED IGD VALUE OBTAINED BY NSGA-II, MOMFEA, EBS, MATEA AND EMaTO-MKT OF TASK<sub>1</sub> TO TASK<sub>50</sub> ON WCCI20-MOMATP2 AND WCCI20-MOMATP3 PROBLEMS AFTER 30 INDEPENDENT RUNS, WHERE THE BOLD IS THE BEST RESULT OF ALL ALGORITHMS.

| task            | WCCI20-MOMATP2 |          |          |          |                 | WCCI20-MOMATP3 |          |          |          |                 |
|-----------------|----------------|----------|----------|----------|-----------------|----------------|----------|----------|----------|-----------------|
|                 | NSGA-II        | MOMFEA   | EBS      | MaTEA    | EMaTO-MKT       | NSGA-II        | MOMFEA   | EBS      | MaTEA    | EMaTO-MKT       |
| T <sub>1</sub>  | 2.12E+01       | 2.05E+01 | 2.49E+01 | 1.33E+01 | <b>5.68E+00</b> | 1.16E-02       | 2.12E-02 | 4.64E-02 | 5.92E-03 | <b>2.03E-04</b> |
| T <sub>2</sub>  | 2.11E+01       | 1.74E+01 | 2.02E+01 | 1.28E+01 | <b>5.53E+00</b> | 1.13E-02       | 2.31E-02 | 4.62E-02 | 5.05E-03 | <b>2.07E-04</b> |
| T <sub>3</sub>  | 2.11E+01       | 1.97E+01 | 2.48E+01 | 1.29E+01 | <b>5.56E+00</b> | 1.25E-02       | 2.25E-02 | 4.53E-02 | 5.79E-03 | <b>1.96E-04</b> |
| T <sub>4</sub>  | 2.10E+01       | 1.92E+01 | 2.38E+01 | 1.49E+01 | <b>4.25E+00</b> | 1.20E-02       | 2.27E-02 | 4.58E-02 | 5.76E-03 | <b>2.61E-04</b> |
| T <sub>5</sub>  | 2.16E+01       | 1.90E+01 | 2.26E+01 | 1.31E+01 | <b>5.57E+00</b> | 1.09E-02       | 2.26E-02 | 4.53E-02 | 6.06E-03 | <b>2.37E-04</b> |
| T <sub>6</sub>  | 2.15E+01       | 1.99E+01 | 2.68E+01 | 1.61E+01 | <b>4.87E+00</b> | 1.25E-02       | 2.31E-02 | 4.23E-02 | 5.71E-03 | <b>2.47E-04</b> |
| T <sub>7</sub>  | 2.18E+01       | 1.87E+01 | 2.41E+01 | 1.42E+01 | <b>4.44E+00</b> | 1.20E-02       | 2.18E-02 | 4.28E-02 | 5.94E-03 | <b>2.82E-04</b> |
| T <sub>8</sub>  | 2.17E+01       | 1.81E+01 | 2.36E+01 | 1.30E+01 | <b>4.72E+00</b> | 1.15E-02       | 2.16E-02 | 4.51E-02 | 5.43E-03 | <b>2.13E-04</b> |
| T <sub>9</sub>  | 2.39E+01       | 1.82E+01 | 2.36E+01 | 1.45E+01 | <b>5.11E+00</b> | 1.20E-02       | 2.21E-02 | 4.34E-02 | 5.58E-03 | <b>2.33E-04</b> |
| T <sub>10</sub> | 2.24E+01       | 2.17E+01 | 2.59E+01 | 1.46E+01 | <b>4.60E+00</b> | 1.04E-02       | 2.17E-02 | 4.54E-02 | 5.98E-03 | <b>2.18E-04</b> |
| T <sub>11</sub> | 2.12E+01       | 1.74E+01 | 2.36E+01 | 1.26E+01 | <b>5.17E+00</b> | 1.13E-02       | 2.22E-02 | 4.42E-02 | 4.99E-03 | <b>2.17E-04</b> |
| T <sub>12</sub> | 2.35E+01       | 1.90E+01 | 2.31E+01 | 1.32E+01 | <b>4.72E+00</b> | 1.24E-02       | 2.36E-02 | 4.48E-02 | 6.56E-03 | <b>2.17E-04</b> |
| T <sub>13</sub> | 2.08E+01       | 1.87E+01 | 2.40E+01 | 1.45E+01 | <b>5.55E+00</b> | 1.25E-02       | 2.11E-02 | 4.40E-02 | 5.80E-03 | <b>2.30E-04</b> |
| T <sub>14</sub> | 2.05E+01       | 1.95E+01 | 2.20E+01 | 1.32E+01 | <b>5.18E+00</b> | 1.25E-02       | 2.17E-02 | 4.45E-02 | 5.84E-03 | <b>2.04E-04</b> |
| T <sub>15</sub> | 2.15E+01       | 1.92E+01 | 2.50E+01 | 1.34E+01 | <b>4.29E+00</b> | 1.26E-02       | 2.30E-02 | 4.30E-02 | 6.30E-03 | <b>2.35E-04</b> |
| T <sub>16</sub> | 2.35E+01       | 1.97E+01 | 2.43E+01 | 1.32E+01 | <b>4.10E+00</b> | 1.19E-02       | 2.22E-02 | 4.23E-02 | 5.58E-03 | <b>2.09E-04</b> |
| T <sub>17</sub> | 2.21E+01       | 1.83E+01 | 2.36E+01 | 1.42E+01 | <b>5.52E+00</b> | 1.22E-02       | 2.31E-02 | 4.62E-02 | 5.40E-03 | <b>2.43E-04</b> |
| T <sub>18</sub> | 2.16E+01       | 1.82E+01 | 2.13E+01 | 1.47E+01 | <b>6.09E+00</b> | 1.24E-02       | 2.28E-02 | 4.61E-02 | 5.94E-03 | <b>2.10E-04</b> |
| T <sub>19</sub> | 2.10E+01       | 2.07E+01 | 2.47E+01 | 1.45E+01 | <b>5.62E+00</b> | 1.30E-02       | 2.19E-02 | 4.55E-02 | 6.02E-03 | <b>2.21E-04</b> |
| T <sub>20</sub> | 2.30E+01       | 2.03E+01 | 2.51E+01 | 1.44E+01 | <b>5.41E+00</b> | 1.09E-02       | 2.35E-02 | 4.53E-02 | 6.53E-03 | <b>2.00E-04</b> |
| T <sub>21</sub> | 2.22E+01       | 2.25E+01 | 2.71E+01 | 1.48E+01 | <b>5.13E+00</b> | 1.19E-02       | 2.16E-02 | 4.35E-02 | 5.55E-03 | <b>1.96E-04</b> |
| T <sub>22</sub> | 2.21E+01       | 1.98E+01 | 2.39E+01 | 1.32E+01 | <b>4.99E+00</b> | 1.24E-02       | 2.29E-02 | 4.62E-02 | 5.68E-03 | <b>2.04E-04</b> |
| T <sub>23</sub> | 2.07E+01       | 1.93E+01 | 2.62E+01 | 1.27E+01 | <b>4.59E+00</b> | 1.13E-02       | 2.19E-02 | 4.58E-02 | 5.94E-03 | <b>2.20E-04</b> |
| T <sub>24</sub> | 2.14E+01       | 2.10E+01 | 2.65E+01 | 1.57E+01 | <b>5.05E+00</b> | 1.33E-02       | 2.27E-02 | 4.51E-02 | 5.92E-03 | <b>1.93E-04</b> |
| T <sub>25</sub> | 2.20E+01       | 1.94E+01 | 2.50E+01 | 1.36E+01 | <b>6.47E+00</b> | 1.15E-02       | 2.43E-02 | 4.53E-02 | 6.13E-03 | <b>2.07E-04</b> |
| T <sub>26</sub> | 2.12E+01       | 2.07E+01 | 2.66E+01 | 1.46E+01 | <b>4.28E+00</b> | 1.13E-02       | 2.28E-02 | 4.24E-02 | 6.10E-03 | <b>2.13E-04</b> |
| T <sub>27</sub> | 2.49E+01       | 1.97E+01 | 2.14E+01 | 1.23E+01 | <b>4.20E+00</b> | 1.18E-02       | 2.30E-02 | 4.41E-02 | 5.57E-03 | <b>2.09E-04</b> |
| T <sub>28</sub> | 1.95E+01       | 1.99E+01 | 2.55E+01 | 1.33E+01 | <b>4.09E+00</b> | 1.22E-02       | 2.26E-02 | 4.60E-02 | 6.03E-03 | <b>2.80E-04</b> |
| T <sub>29</sub> | 2.05E+01       | 1.85E+01 | 2.45E+01 | 1.40E+01 | <b>4.96E+00</b> | 1.26E-02       | 2.27E-02 | 4.62E-02 | 5.41E-03 | <b>2.16E-04</b> |
| T <sub>30</sub> | 1.93E+01       | 2.04E+01 | 2.49E+01 | 1.53E+01 | <b>4.24E+00</b> | 1.21E-02       | 2.21E-02 | 4.21E-02 | 5.77E-03 | <b>2.64E-04</b> |
| T <sub>31</sub> | 1.87E+01       | 1.72E+01 | 2.18E+01 | 1.30E+01 | <b>7.15E+00</b> | 1.17E-02       | 2.25E-02 | 4.29E-02 | 5.22E-03 | <b>1.98E-04</b> |
| T <sub>32</sub> | 2.18E+01       | 1.92E+01 | 2.56E+01 | 1.53E+01 | <b>4.70E+00</b> | 1.11E-02       | 2.37E-02 | 4.40E-02 | 5.66E-03 | <b>2.87E-04</b> |
| T <sub>33</sub> | 2.24E+01       | 1.96E+01 | 2.36E+01 | 1.42E+01 | <b>5.22E+00</b> | 1.09E-02       | 2.36E-02 | 4.52E-02 | 5.40E-03 | <b>2.19E-04</b> |
| T <sub>34</sub> | 2.04E+01       | 1.81E+01 | 2.29E+01 | 1.42E+01 | <b>4.81E+00</b> | 1.18E-02       | 2.38E-02 | 4.32E-02 | 5.85E-03 | <b>2.02E-04</b> |
| T <sub>35</sub> | 2.12E+01       | 2.22E+01 | 2.53E+01 | 1.31E+01 | <b>6.15E+00</b> | 1.13E-02       | 2.32E-02 | 4.17E-02 | 5.52E-03 | <b>2.62E-04</b> |
| T <sub>36</sub> | 2.06E+01       | 1.81E+01 | 2.54E+01 | 1.57E+01 | <b>4.69E+00</b> | 1.23E-02       | 2.19E-02 | 4.47E-02 | 5.88E-03 | <b>2.52E-04</b> |
| T <sub>37</sub> | 2.31E+01       | 2.00E+01 | 2.45E+01 | 1.17E+01 | <b>4.85E+00</b> | 1.22E-02       | 2.15E-02 | 4.36E-02 | 5.80E-03 | <b>2.43E-04</b> |
| T <sub>38</sub> | 2.06E+01       | 2.00E+01 | 2.36E+01 | 1.34E+01 | <b>5.29E+00</b> | 1.21E-02       | 2.23E-02 | 4.34E-02 | 6.05E-03 | <b>2.37E-04</b> |
| T <sub>39</sub> | 2.12E+01       | 1.81E+01 | 2.53E+01 | 1.47E+01 | <b>4.18E+00</b> | 1.16E-02       | 2.26E-02 | 4.11E-02 | 5.55E-03 | <b>2.29E-04</b> |
| T <sub>40</sub> | 2.35E+01       | 1.91E+01 | 2.32E+01 | 1.40E+01 | <b>5.25E+00</b> | 1.11E-02       | 2.20E-02 | 4.47E-02 | 5.63E-03 | <b>3.43E-04</b> |
| T <sub>41</sub> | 2.35E+01       | 2.02E+01 | 2.44E+01 | 1.26E+01 | <b>6.90E+00</b> | 1.22E-02       | 2.32E-02 | 4.49E-02 | 6.57E-03 | <b>2.67E-04</b> |
| T <sub>42</sub> | 2.19E+01       | 1.96E+01 | 2.32E+01 | 1.47E+01 | <b>4.19E+00</b> | 1.25E-02       | 2.33E-02 | 4.50E-02 | 6.06E-03 | <b>2.65E-04</b> |
| T <sub>43</sub> | 2.50E+01       | 2.23E+01 | 2.66E+01 | 1.45E+01 | <b>4.31E+00</b> | 1.24E-02       | 2.34E-02 | 4.40E-02 | 6.30E-03 | <b>2.12E-04</b> |
| T <sub>44</sub> | 2.27E+01       | 1.78E+01 | 2.55E+01 | 1.30E+01 | <b>5.10E+00</b> | 1.21E-02       | 2.23E-02 | 4.52E-02 | 6.40E-03 | <b>2.91E-04</b> |
| T <sub>45</sub> | 2.07E+01       | 1.95E+01 | 2.51E+01 | 1.66E+01 | <b>5.83E+00</b> | 1.22E-02       | 2.23E-02 | 4.42E-02 | 4.99E-03 | <b>2.58E-04</b> |
| T <sub>46</sub> | 2.17E+01       | 2.01E+01 | 2.22E+01 | 1.42E+01 | <b>5.42E+00</b> | 1.27E-02       | 2.25E-02 | 4.72E-02 | 5.89E-03 | <b>2.94E-04</b> |
| T <sub>47</sub> | 2.39E+01       | 1.98E+01 | 2.56E+01 | 1.48E+01 | <b>5.88E+00</b> | 1.20E-02       | 2.28E-02 | 4.62E-02 | 6.10E-03 | <b>2.75E-04</b> |
| T <sub>48</sub> | 2.12E+01       | 2.03E+01 | 2.32E+01 | 1.31E+01 | <b>5.42E+00</b> | 1.18E-02       | 2.32E-02 | 4.41E-02 | 6.10E-03 | <b>2.94E-04</b> |
| T <sub>49</sub> | 1.93E+01       | 1.99E+01 | 2.52E+01 | 1.49E+01 | <b>4.56E+00</b> | 1.16E-02       | 2.26E-02 | 4.40E-02 | 5.53E-03 | <b>2.47E-04</b> |
| T <sub>50</sub> | 2.14E+01       | 1.89E+01 | 2.56E+01 | 1.35E+01 | <b>4.56E+00</b> | 1.25E-02       | 2.33E-02 | 4.34E-02 | 5.54E-03 | <b>2.19E-04</b> |

TABLE S18

AVERAGED IGD VALUE OBTAINED BY NSGA-II, MOMFEA, EBS, MATEA AND EMaTO-MKT OF TASK<sub>1</sub> TO TASK<sub>50</sub> ON WCCI20-MOMATP4 AND WCCI20-MOMATP5 PROBLEMS AFTER 30 INDEPENDENT RUNS, WHERE THE BOLD IS THE BEST RESULT OF ALL ALGORITHMS.

| task            | WCCI20-MOMATP4 |          |          |                 |                 | WCCI20-MOMATP5 |          |          |          |                 |
|-----------------|----------------|----------|----------|-----------------|-----------------|----------------|----------|----------|----------|-----------------|
|                 | NSGA-II        | MOMFEA   | EBS      | MaTEA           | EMaTO-MKT       | NSGA-II        | MOMFEA   | EBS      | MaTEA    | EMaTO-MKT       |
| T <sub>1</sub>  | 1.29E-01       | 2.18E-01 | 3.74E+02 | 3.88E-02        | <b>1.66E-04</b> | 1.64E+01       | 1.71E+01 | 1.14E+02 | 2.06E+01 | <b>6.05E+00</b> |
| T <sub>2</sub>  | 9.22E+01       | 2.02E+02 | 1.23E+06 | 3.44E+01        | <b>3.34E+00</b> | 9.71E-03       | 2.33E-02 | 1.44E-01 | 6.31E-03 | <b>2.49E-04</b> |
| T <sub>3</sub>  | 6.42E-01       | 1.84E-01 | 5.49E-01 | 1.26E-01        | <b>2.42E-03</b> | 1.57E+00       | 1.30E+00 | 1.51E+00 | 1.40E+00 | <b>8.13E-01</b> |
| T <sub>4</sub>  | 1.24E-01       | 2.48E-01 | 3.88E+02 | 4.09E-02        | <b>1.66E-04</b> | 2.02E+01       | 1.64E+01 | 1.02E+02 | 1.84E+01 | <b>4.72E+00</b> |
| T <sub>5</sub>  | 3.43E+01       | 8.27E+01 | 1.93E+06 | 1.14E+01        | <b>9.41E+00</b> | 1.04E-02       | 2.06E-02 | 1.60E-01 | 5.75E-03 | <b>3.26E-04</b> |
| T <sub>6</sub>  | 6.39E-01       | 1.03E-01 | 5.25E-01 | 1.36E-01        | <b>1.56E-03</b> | 1.56E+00       | 1.18E+00 | 1.52E+00 | 1.51E+00 | <b>6.39E-01</b> |
| T <sub>7</sub>  | 1.25E-01       | 1.76E-01 | 4.27E+02 | 4.35E-02        | <b>1.67E-04</b> | 1.92E+01       | 2.08E+01 | 1.10E+02 | 1.75E+01 | <b>6.57E+00</b> |
| T <sub>8</sub>  | 4.29E+01       | 3.03E+01 | 1.23E+06 | 2.49E+01        | <b>2.72E+00</b> | 9.91E-03       | 2.25E-02 | 1.37E-01 | 5.65E-03 | <b>3.05E-04</b> |
| T <sub>9</sub>  | 6.41E-01       | 1.91E-01 | 5.57E-01 | 1.24E-01        | <b>1.92E-04</b> | 1.69E+00       | 1.01E+00 | 1.37E+00 | 1.50E+00 | <b>6.00E-01</b> |
| T <sub>10</sub> | 1.49E-01       | 3.40E-01 | 3.90E+02 | 4.07E-02        | <b>1.67E-04</b> | 1.85E+01       | 1.66E+01 | 1.28E+02 | 2.35E+01 | <b>9.85E+00</b> |
| T <sub>11</sub> | 3.01E+01       | 3.63E+01 | 1.76E+06 | <b>1.15E+01</b> | 2.24E+01        | 1.04E-02       | 2.42E-02 | 1.27E-01 | 6.11E-03 | <b>2.38E-04</b> |
| T <sub>12</sub> | 6.42E-01       | 1.17E-01 | 5.67E-01 | 1.18E-01        | <b>1.49E-02</b> | 1.60E+00       | 1.12E+00 | 1.39E+00 | 1.41E+00 | <b>5.24E-01</b> |
| T <sub>13</sub> | 1.08E-01       | 3.04E-01 | 3.49E+02 | 4.28E-02        | <b>1.66E-04</b> | 1.74E+01       | 2.07E+01 | 1.14E+02 | 2.03E+01 | <b>6.23E+00</b> |
| T <sub>14</sub> | 4.84E+01       | 6.14E+01 | 2.03E+06 | 2.93E+01        | <b>1.07E+01</b> | 9.99E-03       | 2.46E-02 | 1.43E-01 | 6.19E-03 | <b>3.55E-04</b> |
| T <sub>15</sub> | 6.40E-01       | 1.19E-01 | 5.63E-01 | 2.89E-01        | <b>6.94E-03</b> | 1.62E+00       | 1.15E+00 | 1.41E+00 | 1.25E+00 | <b>4.95E-01</b> |
| T <sub>16</sub> | 1.02E-01       | 3.08E-01 | 3.85E+02 | 3.78E-02        | <b>1.67E-04</b> | 1.95E+01       | 1.63E+01 | 8.49E+01 | 2.24E+01 | <b>6.14E+00</b> |
| T <sub>17</sub> | 6.03E+01       | 4.64E+01 | 1.70E+06 | 1.48E+01        | <b>3.48E+00</b> | 1.02E-02       | 2.23E-02 | 1.44E-01 | 5.92E-03 | <b>4.06E-04</b> |
| T <sub>18</sub> | 6.43E-01       | 1.98E-01 | 5.83E-01 | 4.44E-01        | <b>2.59E-04</b> | 1.64E+00       | 1.17E+00 | 1.38E+00 | 1.49E+00 | <b>7.31E-01</b> |
| T <sub>19</sub> | 1.14E-01       | 2.91E-01 | 4.01E+02 | 4.33E-02        | <b>1.68E-04</b> | 2.05E+01       | 1.92E+01 | 1.09E+02 | 1.66E+01 | <b>4.36E+00</b> |
| T <sub>20</sub> | 1.10E+02       | 3.80E+01 | 8.67E+05 | 1.07E+01        | <b>3.55E+00</b> | 8.85E-03       | 2.03E-02 | 1.10E-01 | 4.88E-03 | <b>3.01E-04</b> |
| T <sub>21</sub> | 6.42E-01       | 1.20E-01 | 5.70E-01 | 1.75E-01        | <b>3.80E-04</b> | 1.54E+00       | 1.35E+00 | 1.43E+00 | 1.54E+00 | <b>6.35E-01</b> |
| T <sub>22</sub> | 1.30E-01       | 2.69E-01 | 4.80E+02 | 4.68E-02        | <b>1.66E-04</b> | 1.87E+01       | 1.73E+01 | 1.09E+02 | 1.68E+01 | <b>6.28E+00</b> |
| T <sub>23</sub> | 3.24E+02       | 6.71E+01 | 1.66E+06 | <b>2.41E+01</b> | 5.94E+01        | 1.11E-02       | 2.44E-02 | 1.32E-01 | 4.60E-03 | <b>2.95E-04</b> |
| T <sub>24</sub> | 6.41E-01       | 1.32E-01 | 5.72E-01 | 2.08E-01        | <b>4.05E-03</b> | 1.69E+00       | 1.09E+00 | 1.36E+00 | 1.35E+00 | <b>7.92E-01</b> |
| T <sub>25</sub> | 1.01E-01       | 2.20E-01 | 3.59E+02 | 4.80E-02        | <b>1.66E-04</b> | 1.69E+01       | 2.18E+01 | 1.26E+02 | 2.15E+01 | <b>7.41E+00</b> |
| T <sub>26</sub> | 2.47E+02       | 4.63E+01 | 1.15E+06 | 7.88E+00        | <b>4.07E+00</b> | 9.29E-03       | 2.14E-02 | 1.29E-01 | 5.87E-03 | <b>2.32E-04</b> |
| T <sub>27</sub> | 6.42E-01       | 3.43E-01 | 5.86E-01 | 1.91E-01        | <b>5.24E-03</b> | 1.78E+00       | 1.11E+00 | 1.37E+00 | 1.63E+00 | <b>7.30E-01</b> |
| T <sub>28</sub> | 1.23E-01       | 4.67E-01 | 4.34E+02 | 4.47E-02        | <b>1.63E-04</b> | 1.68E+01       | 1.44E+01 | 1.25E+02 | 2.03E+01 | <b>4.28E+00</b> |
| T <sub>29</sub> | 6.17E+01       | 8.30E+01 | 1.81E+06 | 3.90E+01        | <b>2.48E+01</b> | 1.06E-02       | 2.44E-02 | 1.70E-01 | 5.53E-03 | <b>3.60E-04</b> |
| T <sub>30</sub> | 6.42E-01       | 1.13E-01 | 5.75E-01 | 1.14E-01        | <b>5.16E-04</b> | 1.67E+00       | 1.20E+00 | 1.41E+00 | 1.22E+00 | <b>6.25E-01</b> |
| T <sub>31</sub> | 1.10E-01       | 2.30E-01 | 4.20E+02 | 4.06E-02        | <b>1.67E-04</b> | 2.12E+01       | 1.57E+01 | 1.26E+02 | 2.37E+01 | <b>4.98E+00</b> |
| T <sub>32</sub> | 5.24E+01       | 1.26E+02 | 1.38E+06 | 3.07E+01        | <b>5.76E+00</b> | 1.05E-02       | 2.18E-02 | 1.37E-01 | 5.52E-03 | <b>2.46E-04</b> |
| T <sub>33</sub> | 6.42E-01       | 2.72E-01 | 5.71E-01 | 2.02E-01        | <b>7.97E-03</b> | 1.72E+00       | 1.15E+00 | 1.47E+00 | 1.46E+00 | <b>6.76E-01</b> |
| T <sub>34</sub> | 1.28E-01       | 2.00E-01 | 3.47E+02 | 4.22E-02        | <b>1.65E-04</b> | 2.06E+01       | 1.84E+01 | 1.16E+02 | 2.06E+01 | <b>5.29E+00</b> |
| T <sub>35</sub> | 2.10E+01       | 6.48E+01 | 1.25E+06 | 1.13E+01        | <b>4.35E+00</b> | 8.56E-03       | 2.23E-02 | 1.64E-01 | 6.01E-03 | <b>3.07E-04</b> |
| T <sub>36</sub> | 6.42E-01       | 2.62E-01 | 5.61E-01 | 1.30E-01        | <b>5.90E-03</b> | 1.63E+00       | 1.13E+00 | 1.25E+00 | 1.36E+00 | <b>5.72E-01</b> |
| T <sub>37</sub> | 1.12E-01       | 2.74E-01 | 4.33E+02 | 3.68E-02        | <b>1.68E-04</b> | 1.77E+01       | 1.95E+01 | 1.14E+02 | 2.16E+01 | <b>4.78E+00</b> |
| T <sub>38</sub> | 5.08E+01       | 9.39E+01 | 1.94E+06 | 2.78E+01        | <b>2.80E+00</b> | 1.03E-02       | 2.15E-02 | 1.20E-01 | 5.43E-03 | <b>2.38E-04</b> |
| T <sub>39</sub> | 6.40E-01       | 1.99E-01 | 5.72E-01 | 1.22E-01        | <b>5.13E-04</b> | 1.56E+00       | 1.07E+00 | 1.41E+00 | 1.35E+00 | <b>5.75E-01</b> |
| T <sub>40</sub> | 1.24E-01       | 1.68E-01 | 3.66E+02 | 4.00E-02        | <b>1.68E-04</b> | 1.48E+01       | 1.68E+01 | 9.66E+01 | 2.26E+01 | <b>5.20E+00</b> |
| T <sub>41</sub> | 1.20E+02       | 4.21E+01 | 1.33E+06 | 1.23E+01        | <b>1.02E+01</b> | 1.07E-02       | 2.31E-02 | 1.59E-01 | 5.40E-03 | <b>2.82E-04</b> |
| T <sub>42</sub> | 6.42E-01       | 1.96E-01 | 5.59E-01 | 2.90E-01        | <b>1.00E-02</b> | 1.59E+00       | 1.21E+00 | 1.38E+00 | 1.32E+00 | <b>6.01E-01</b> |
| T <sub>43</sub> | 1.15E-01       | 3.46E-01 | 2.69E+02 | 4.24E-02        | <b>1.67E-04</b> | 1.93E+01       | 1.64E+01 | 1.11E+02 | 2.44E+01 | <b>4.92E+00</b> |
| T <sub>44</sub> | 3.88E+01       | 8.98E+01 | 1.70E+06 | <b>1.09E+01</b> | 3.39E+01        | 9.37E-03       | 2.37E-02 | 1.31E-01 | 5.51E-03 | <b>3.97E-04</b> |
| T <sub>45</sub> | 6.42E-01       | 1.98E-01 | 5.53E-01 | 1.16E-01        | <b>4.97E-03</b> | 1.51E+00       | 1.08E+00 | 1.43E+00 | 1.28E+00 | <b>4.28E-01</b> |
| T <sub>46</sub> | 1.24E-01       | 2.56E-01 | 3.54E+02 | 3.80E-02        | <b>1.65E-04</b> | 1.83E+01       | 1.67E+01 | 1.01E+02 | 2.04E+01 | <b>6.54E+00</b> |
| T <sub>47</sub> | 1.93E+02       | 9.68E+01 | 1.73E+06 | 8.54E+00        | <b>5.77E+00</b> | 8.45E-03       | 2.23E-02 | 1.40E-01 | 5.77E-03 | <b>3.01E-04</b> |
| T <sub>48</sub> | 6.41E-01       | 3.45E-01 | 5.64E-01 | 2.18E-01        | <b>5.56E-03</b> | 1.58E+00       | 1.14E+00 | 1.38E+00 | 1.34E+00 | <b>6.81E-01</b> |
| T <sub>49</sub> | 1.30E-01       | 2.69E-01 | 3.88E+02 | 3.84E-02        | <b>1.66E-04</b> | 1.56E+01       | 1.80E+01 | 1.25E+02 | 2.01E+01 | <b>4.52E+00</b> |
| T <sub>50</sub> | 8.54E+01       | 5.26E+01 | 1.23E+06 | 1.15E+01        | <b>3.04E+00</b> | 1.03E-02       | 2.31E-02 | 1.42E-01 | 5.24E-03 | <b>4.15E-04</b> |

TABLE S19

AVERAGED IGD VALUE OBTAINED BY NSGA-II, MOMFEA, EBS, MATEA AND EMaTO-MKT OF TASK<sub>1</sub> TO TASK<sub>50</sub> ON WCCI20-MOMATP6 AND WCCI20-MOMATP7 PROBLEMS AFTER 30 INDEPENDENT RUNS, WHERE THE BOLD IS THE BEST RESULT OF ALL ALGORITHMS.

| task            | WCCI20-MOMATP6 |          |          |                 |                 | WCCI20-MOMATP7 |          |          |          |                 |
|-----------------|----------------|----------|----------|-----------------|-----------------|----------------|----------|----------|----------|-----------------|
|                 | NSGA-II        | MOMFEA   | EBS      | MaTEA           | EMaTO-MKT       | NSGA-II        | MOMFEA   | EBS      | MaTEA    | EMaTO-MKT       |
| T <sub>1</sub>  | 9.75E+01       | 6.19E+01 | 6.15E+05 | 1.06E+01        | <b>3.00E+00</b> | 1.47E-01       | 2.82E-01 | 4.47E+02 | 4.27E-02 | <b>1.68E-04</b> |
| T <sub>2</sub>  | 1.25E-02       | 2.15E-02 | 1.19E-01 | 5.71E-03        | <b>2.78E-04</b> | 6.41E-01       | 1.88E-01 | 5.78E-01 | 1.20E-01 | <b>5.36E-03</b> |
| T <sub>3</sub>  | 1.51E+00       | 1.17E+00 | 1.31E+00 | 1.29E+00        | <b>8.50E-01</b> | 1.67E+01       | 1.65E+01 | 9.40E+01 | 1.65E+01 | <b>5.63E+00</b> |
| T <sub>4</sub>  | 4.27E+01       | 3.70E+01 | 1.26E+06 | 1.72E+01        | <b>7.19E+00</b> | 1.28E-01       | 2.83E-01 | 3.83E+02 | 4.60E-02 | <b>1.69E-04</b> |
| T <sub>5</sub>  | 1.10E-02       | 2.45E-02 | 1.40E-01 | 6.36E-03        | <b>3.10E-04</b> | 6.41E-01       | 1.97E-01 | 5.79E-01 | 2.68E-01 | <b>6.43E-04</b> |
| T <sub>6</sub>  | 1.70E+00       | 1.27E+00 | 1.41E+00 | 1.42E+00        | <b>6.33E-01</b> | 1.65E+01       | 1.99E+01 | 1.14E+02 | 2.22E+01 | <b>5.69E+00</b> |
| T <sub>7</sub>  | 5.17E+01       | 3.89E+01 | 1.72E+06 | 1.48E+01        | <b>3.06E+00</b> | 1.12E-01       | 2.87E-01 | 3.11E+02 | 4.79E-02 | <b>1.65E-04</b> |
| T <sub>8</sub>  | 1.02E-02       | 2.29E-02 | 1.55E-01 | 6.16E-03        | <b>3.58E-04</b> | 6.40E-01       | 1.91E-01 | 5.67E-01 | 2.99E-01 | <b>6.12E-03</b> |
| T <sub>9</sub>  | 1.51E+00       | 1.15E+00 | 1.26E+00 | 1.20E+00        | <b>4.10E-01</b> | 1.98E+01       | 1.45E+01 | 1.15E+02 | 2.12E+01 | <b>4.52E+00</b> |
| T <sub>10</sub> | 2.17E+01       | 6.39E+01 | 1.77E+06 | 1.26E+01        | <b>1.10E+01</b> | 1.45E-01       | 2.35E-01 | 3.71E+02 | 4.08E-02 | <b>1.66E-04</b> |
| T <sub>11</sub> | 1.25E-02       | 2.18E-02 | 1.31E-01 | 6.07E-03        | <b>3.46E-04</b> | 6.41E-01       | 2.74E-01 | 5.77E-01 | 1.99E-01 | <b>5.18E-03</b> |
| T <sub>12</sub> | 1.67E+00       | 1.16E+00 | 1.35E+00 | 1.35E+00        | <b>5.32E-01</b> | 1.75E+01       | 1.78E+01 | 1.21E+02 | 2.22E+01 | <b>4.98E+00</b> |
| T <sub>13</sub> | 2.61E+01       | 6.50E+01 | 9.15E+05 | 1.36E+01        | <b>3.49E+00</b> | 1.11E-01       | 2.90E-01 | 2.84E+02 | 4.16E-02 | <b>1.67E-04</b> |
| T <sub>14</sub> | 9.04E-03       | 2.14E-02 | 1.29E-01 | 5.69E-03        | <b>3.84E-04</b> | 6.41E-01       | 2.66E-01 | 5.86E-01 | 2.19E-01 | <b>9.86E-04</b> |
| T <sub>15</sub> | 1.62E+00       | 1.14E+00 | 1.34E+00 | 1.16E+00        | <b>6.40E-01</b> | 2.10E+01       | 1.89E+01 | 1.04E+02 | 2.13E+01 | <b>5.73E+00</b> |
| T <sub>16</sub> | 5.21E+01       | 6.12E+01 | 1.29E+06 | 1.05E+01        | <b>4.40E+00</b> | 1.11E-01       | 3.14E-01 | 4.13E+02 | 3.79E-02 | <b>1.67E-04</b> |
| T <sub>17</sub> | 9.89E-03       | 2.47E-02 | 1.49E-01 | 5.69E-03        | <b>2.38E-04</b> | 6.42E-01       | 1.17E-01 | 5.63E-01 | 1.77E-01 | <b>7.12E-04</b> |
| T <sub>18</sub> | 1.55E+00       | 1.29E+00 | 1.47E+00 | 1.42E+00        | <b>7.69E-01</b> | 1.96E+01       | 1.59E+01 | 9.22E+01 | 2.42E+01 | <b>4.32E+00</b> |
| T <sub>19</sub> | 9.12E+01       | 9.45E+01 | 2.27E+06 | 1.02E+01        | <b>4.18E+00</b> | 1.19E-01       | 2.41E-01 | 3.93E+02 | 4.64E-02 | <b>1.64E-04</b> |
| T <sub>20</sub> | 9.21E-03       | 2.14E-02 | 1.32E-01 | 5.63E-03        | <b>2.66E-04</b> | 6.40E-01       | 1.14E-01 | 5.70E-01 | 2.89E-01 | <b>2.08E-04</b> |
| T <sub>21</sub> | 1.59E+00       | 1.31E+00 | 1.43E+00 | 1.49E+00        | <b>6.25E-01</b> | 1.68E+01       | 1.84E+01 | 1.07E+02 | 2.04E+01 | <b>6.64E+00</b> |
| T <sub>22</sub> | 1.66E+02       | 1.02E+02 | 1.43E+06 | 9.25E+00        | <b>3.26E+00</b> | 1.38E-01       | 2.42E-01 | 3.61E+02 | 3.89E-02 | <b>1.64E-04</b> |
| T <sub>23</sub> | 1.01E-02       | 2.30E-02 | 1.50E-01 | 6.15E-03        | <b>3.72E-04</b> | 6.42E-01       | 2.62E-01 | 5.75E-01 | 1.08E-01 | <b>3.94E-03</b> |
| T <sub>24</sub> | 1.66E+00       | 1.12E+00 | 1.31E+00 | 1.46E+00        | <b>5.42E-01</b> | 1.79E+01       | 1.81E+01 | 1.17E+02 | 1.89E+01 | <b>4.28E+00</b> |
| T <sub>25</sub> | 1.06E+02       | 7.39E+01 | 2.42E+06 | <b>2.46E+01</b> | 3.41E+01        | 1.23E-01       | 2.94E-01 | 3.99E+02 | 4.51E-02 | <b>1.67E-04</b> |
| T <sub>26</sub> | 1.03E-02       | 2.13E-02 | 1.34E-01 | 5.80E-03        | <b>2.76E-04</b> | 6.39E-01       | 3.35E-01 | 5.82E-01 | 1.89E-01 | <b>1.33E-03</b> |
| T <sub>27</sub> | 1.66E+00       | 1.35E+00 | 1.47E+00 | 1.46E+00        | <b>6.46E-01</b> | 1.79E+01       | 1.75E+01 | 1.25E+02 | 2.27E+01 | <b>5.82E+00</b> |
| T <sub>28</sub> | 1.62E+02       | 2.85E+01 | 2.25E+06 | 8.23E+00        | <b>3.14E+00</b> | 1.08E-01       | 2.57E-01 | 3.87E+02 | 4.08E-02 | <b>1.69E-04</b> |
| T <sub>29</sub> | 8.98E-03       | 2.46E-02 | 1.30E-01 | 5.64E-03        | <b>3.27E-04</b> | 6.41E-01       | 1.95E-01 | 5.72E-01 | 3.00E-01 | <b>7.94E-04</b> |
| T <sub>30</sub> | 1.61E+00       | 1.17E+00 | 1.34E+00 | 1.48E+00        | <b>5.26E-01</b> | 1.82E+01       | 1.55E+01 | 9.95E+01 | 2.07E+01 | <b>5.53E+00</b> |
| T <sub>31</sub> | 4.13E+01       | 3.38E+01 | 2.28E+06 | 2.34E+01        | <b>8.12E+00</b> | 1.05E-01       | 2.42E-01 | 4.21E+02 | 4.31E-02 | <b>1.77E-04</b> |
| T <sub>32</sub> | 1.01E-02       | 2.17E-02 | 1.35E-01 | 6.58E-03        | <b>3.49E-04</b> | 6.41E-01       | 2.69E-01 | 5.69E-01 | 1.26E-01 | <b>3.33E-04</b> |
| T <sub>33</sub> | 1.65E+00       | 1.19E+00 | 1.43E+00 | 1.21E+00        | <b>5.97E-01</b> | 1.75E+01       | 1.52E+01 | 1.28E+02 | 1.88E+01 | <b>5.06E+00</b> |
| T <sub>34</sub> | 4.33E+01       | 6.45E+01 | 8.28E+05 | 1.19E+01        | <b>2.39E+00</b> | 1.19E-01       | 2.25E-01 | 3.75E+02 | 4.76E-02 | <b>1.69E-04</b> |
| T <sub>35</sub> | 9.14E-03       | 2.25E-02 | 1.56E-01 | 9.12E-03        | <b>4.09E-04</b> | 6.41E-01       | 1.15E-01 | 5.64E-01 | 2.27E-01 | <b>6.74E-04</b> |
| T <sub>36</sub> | 1.72E+00       | 1.10E+00 | 1.42E+00 | 1.40E+00        | <b>5.37E-01</b> | 1.87E+01       | 1.66E+01 | 1.14E+02 | 1.90E+01 | <b>4.88E+00</b> |
| T <sub>37</sub> | 1.94E+01       | 5.83E+01 | 1.49E+06 | 1.19E+01        | <b>4.59E+00</b> | 1.43E-01       | 2.22E-01 | 3.98E+02 | 4.55E-02 | <b>1.67E-04</b> |
| T <sub>38</sub> | 1.36E-02       | 2.33E-02 | 1.39E-01 | 5.99E-03        | <b>2.59E-04</b> | 6.40E-01       | 3.40E-01 | 5.79E-01 | 2.19E-01 | <b>3.97E-03</b> |
| T <sub>39</sub> | 1.70E+00       | 1.16E+00 | 1.37E+00 | 1.11E+00        | <b>6.33E-01</b> | 1.73E+01       | 1.91E+01 | 1.43E+02 | 2.29E+01 | <b>5.03E+00</b> |
| T <sub>40</sub> | 2.07E+02       | 4.40E+01 | 1.81E+06 | 1.91E+01        | <b>2.94E+00</b> | 1.17E-01       | 3.07E-01 | 4.37E+02 | 4.68E-02 | <b>1.65E-04</b> |
| T <sub>41</sub> | 9.95E-03       | 2.27E-02 | 1.19E-01 | 5.92E-03        | <b>3.00E-04</b> | 6.40E-01       | 1.26E-01 | 5.51E-01 | 1.85E-01 | <b>4.49E-04</b> |
| T <sub>42</sub> | 1.60E+00       | 1.20E+00 | 1.41E+00 | 1.39E+00        | <b>5.75E-01</b> | 1.98E+01       | 1.67E+01 | 1.22E+02 | 2.13E+01 | <b>6.35E+00</b> |
| T <sub>43</sub> | 6.47E+01       | 1.56E+01 | 1.20E+06 | 1.20E+01        | <b>4.29E+00</b> | 1.35E-01       | 2.57E-01 | 4.27E+02 | 4.21E-02 | <b>1.67E-04</b> |
| T <sub>44</sub> | 1.11E-02       | 2.13E-02 | 1.40E-01 | 5.91E-03        | <b>3.19E-04</b> | 6.40E-01       | 1.90E-01 | 5.75E-01 | 3.75E-01 | <b>5.26E-03</b> |
| T <sub>45</sub> | 1.74E+00       | 1.29E+00 | 1.41E+00 | 1.43E+00        | <b>5.94E-01</b> | 1.89E+01       | 1.66E+01 | 1.08E+02 | 2.36E+01 | <b>5.56E+00</b> |
| T <sub>46</sub> | 9.40E+01       | 6.58E+01 | 1.71E+06 | 2.03E+01        | <b>1.90E+00</b> | 1.11E-01       | 2.57E-01 | 3.99E+02 | 4.56E-02 | <b>1.65E-04</b> |
| T <sub>47</sub> | 1.19E-02       | 2.29E-02 | 1.44E-01 | 5.64E-03        | <b>2.56E-04</b> | 6.42E-01       | 1.20E-01 | 5.46E-01 | 1.22E-01 | <b>1.41E-02</b> |
| T <sub>48</sub> | 1.60E+00       | 1.28E+00 | 1.44E+00 | 1.39E+00        | <b>8.19E-01</b> | 1.72E+01       | 1.54E+01 | 9.28E+01 | 2.27E+01 | <b>6.21E+00</b> |
| T <sub>49</sub> | 4.44E+01       | 8.16E+01 | 1.03E+06 | 8.63E+00        | <b>3.85E+00</b> | 9.95E-02       | 2.44E-01 | 4.01E+02 | 4.54E-02 | <b>1.66E-04</b> |
| T <sub>50</sub> | 1.12E-02       | 2.23E-02 | 1.57E-01 | 6.56E-03        | <b>2.75E-04</b> | 6.41E-01       | 1.23E-01 | 5.62E-01 | 1.36E-01 | <b>4.22E-03</b> |

TABLE S20

AVERAGED IGD VALUE OBTAINED BY NSGA-II, MOMFEA, EBS, MATEA AND EMaTO-MKT OF TASK<sub>1</sub> TO TASK<sub>50</sub> ON WCCI20-MOMATP8 AND WCCI20-MOMATP9 PROBLEMS AFTER 30 INDEPENDENT RUNS, WHERE THE BOLD IS THE BEST RESULT OF ALL ALGORITHMS.

| task            | WCCI20-MOMATP8 |          |          |                 |                 | WCCI20-MOMATP9  |          |          |                 |                 |
|-----------------|----------------|----------|----------|-----------------|-----------------|-----------------|----------|----------|-----------------|-----------------|
|                 | NSGA-II        | MOMFEA   | EBS      | MaTEA           | EMaTO-MKT       | NSGA-II         | MOMFEA   | EBS      | MaTEA           | EMaTO-MKT       |
| T <sub>1</sub>  | 1.33E-01       | 3.37E-01 | 1.42E+03 | 4.45E-02        | <b>1.65E-04</b> | <b>5.11E+01</b> | 2.01E+02 | 2.72E+07 | 1.41E+02        | 5.38E+01        |
| T <sub>2</sub>  | 9.80E+01       | 2.33E+02 | 2.57E+07 | <b>8.20E+01</b> | 1.00E+02        | 5.40E-01        | 5.29E-01 | 5.54E-01 | 5.17E-01        | <b>2.03E-04</b> |
| T <sub>3</sub>  | 5.29E-01       | 5.28E-01 | 5.54E-01 | 4.21E-01        | <b>1.85E-04</b> | 1.99E+01        | 1.41E+01 | 4.12E+02 | 2.31E+01        | <b>6.13E+00</b> |
| T <sub>4</sub>  | 2.30E+01       | 1.73E+01 | 3.25E+02 | 2.40E+01        | <b>6.40E+00</b> | 1.10E-02        | 1.85E-02 | 3.34E-01 | 8.12E-03        | <b>2.26E-04</b> |
| T <sub>5</sub>  | 1.34E+00       | 1.48E+00 | 1.90E+00 | 1.42E+00        | <b>8.78E-01</b> | 1.44E+00        | 1.60E+00 | 1.94E+00 | 1.38E+00        | <b>8.18E-01</b> |
| T <sub>6</sub>  | 1.23E-01       | 3.65E-01 | 1.35E+03 | 4.80E-02        | <b>1.67E-04</b> | 5.52E+02        | 3.34E+02 | 1.73E+07 | 4.09E+01        | <b>1.46E+01</b> |
| T <sub>7</sub>  | 7.31E+01       | 1.17E+02 | 3.07E+07 | 4.36E+01        | <b>2.43E+01</b> | 5.27E-01        | 5.29E-01 | 5.53E-01 | 5.11E-01        | <b>3.02E-04</b> |
| T <sub>8</sub>  | 5.35E-01       | 5.29E-01 | 5.53E-01 | 4.84E-01        | <b>3.31E-04</b> | 2.31E+01        | 1.42E+01 | 3.53E+02 | 2.30E+01        | <b>5.34E+00</b> |
| T <sub>9</sub>  | 2.06E+01       | 1.59E+01 | 3.21E+02 | 2.62E+01        | <b>5.43E+00</b> | 1.07E-02        | 1.89E-02 | 3.60E-01 | 8.78E-03        | <b>2.03E-04</b> |
| T <sub>10</sub> | 1.51E+00       | 1.52E+00 | 1.98E+00 | 1.42E+00        | <b>9.70E-01</b> | 1.44E+00        | 1.46E+00 | 1.86E+00 | 1.41E+00        | <b>9.19E-01</b> |
| T <sub>11</sub> | 1.58E-01       | 3.71E-01 | 1.51E+03 | 6.41E-02        | <b>1.64E-04</b> | 6.37E+01        | 8.16E+01 | 2.70E+07 | 7.16E+01        | <b>5.35E+01</b> |
| T <sub>12</sub> | 1.83E+02       | 6.95E+01 | 2.92E+07 | <b>2.40E+01</b> | 3.66E+01        | 5.29E-01        | 5.29E-01 | 5.55E-01 | 5.02E-01        | <b>2.56E-03</b> |
| T <sub>13</sub> | 5.35E-01       | 5.30E-01 | 5.55E-01 | 5.01E-01        | <b>5.56E-03</b> | 1.88E+01        | 1.65E+01 | 3.11E+02 | 2.55E+01        | <b>4.65E+00</b> |
| T <sub>14</sub> | 2.20E+01       | 1.53E+01 | 2.86E+02 | 2.28E+01        | <b>8.37E+00</b> | 1.15E-02        | 1.88E-02 | 3.78E-01 | 8.34E-03        | <b>2.02E-04</b> |
| T <sub>15</sub> | 1.49E+00       | 1.45E+00 | 1.91E+00 | 1.44E+00        | <b>9.88E-01</b> | 1.32E+00        | 1.48E+00 | 1.93E+00 | 1.39E+00        | <b>1.01E+00</b> |
| T <sub>16</sub> | 1.20E-01       | 2.97E-01 | 1.30E+03 | 4.28E-02        | <b>1.67E-04</b> | 1.62E+02        | 2.46E+02 | 2.35E+07 | 4.07E+01        | <b>1.01E+01</b> |
| T <sub>17</sub> | 5.02E+01       | 7.58E+01 | 2.53E+07 | 1.00E+02        | <b>3.89E+01</b> | 5.28E-01        | 5.29E-01 | 5.53E-01 | 5.08E-01        | <b>2.57E-04</b> |
| T <sub>18</sub> | 5.33E-01       | 5.30E-01 | 5.53E-01 | 5.01E-01        | <b>7.74E-04</b> | 2.12E+01        | 1.45E+01 | 4.08E+02 | 2.42E+01        | <b>5.13E+00</b> |
| T <sub>19</sub> | 1.84E+01       | 1.72E+01 | 3.71E+02 | 2.16E+01        | <b>7.66E+00</b> | 1.14E-02        | 2.02E-02 | 3.68E-01 | 9.45E-03        | <b>2.30E-04</b> |
| T <sub>20</sub> | 1.42E+00       | 1.53E+00 | 2.01E+00 | 1.38E+00        | <b>9.94E-01</b> | 1.50E+00        | 1.52E+00 | 1.88E+00 | 1.36E+00        | <b>9.35E-01</b> |
| T <sub>21</sub> | 1.67E-01       | 2.57E-01 | 1.49E+03 | 5.07E-02        | <b>1.64E-04</b> | 1.16E+02        | 7.55E+01 | 2.59E+07 | <b>2.87E+01</b> | 5.93E+01        |
| T <sub>22</sub> | 8.95E+01       | 9.79E+01 | 2.03E+07 | 6.87E+01        | <b>3.43E+01</b> | 5.32E-01        | 5.27E-01 | 5.53E-01 | 4.98E-01        | <b>2.63E-03</b> |
| T <sub>23</sub> | 5.24E-01       | 5.29E-01 | 5.56E-01 | 4.92E-01        | <b>2.00E-04</b> | 2.56E+01        | 1.35E+01 | 3.45E+02 | 2.50E+01        | <b>6.22E+00</b> |
| T <sub>24</sub> | 2.42E+01       | 1.77E+01 | 4.18E+02 | 2.86E+01        | <b>6.80E+00</b> | 1.12E-02        | 1.82E-02 | 3.39E-01 | 8.36E-03        | <b>2.27E-04</b> |
| T <sub>25</sub> | 1.39E+00       | 1.56E+00 | 1.90E+00 | 1.37E+00        | <b>8.81E-01</b> | 1.33E+00        | 1.38E+00 | 1.56E+00 | 1.45E+00        | <b>7.41E-01</b> |
| T <sub>26</sub> | 1.21E-01       | 2.98E-01 | 1.30E+03 | 5.23E-02        | <b>1.65E-04</b> | 3.12E+02        | 1.52E+02 | 1.22E+07 | 8.43E+01        | <b>1.11E+01</b> |
| T <sub>27</sub> | 2.99E+02       | 2.44E+02 | 2.00E+07 | 1.05E+02        | <b>1.86E+00</b> | 5.28E-01        | 5.28E-01 | 5.52E-01 | 4.95E-01        | <b>2.53E-04</b> |
| T <sub>28</sub> | 5.31E-01       | 5.29E-01 | 5.55E-01 | 5.03E-01        | <b>3.01E-03</b> | 2.64E+01        | 1.49E+01 | 4.56E+02 | 5.82E+01        | <b>5.74E+00</b> |
| T <sub>29</sub> | 2.10E+01       | 1.72E+01 | 3.39E+02 | 2.47E+01        | <b>7.89E+00</b> | 1.31E-02        | 1.96E-02 | 4.54E-01 | 9.75E-03        | <b>2.07E-04</b> |
| T <sub>30</sub> | 1.44E+00       | 1.46E+00 | 1.83E+00 | 1.40E+00        | <b>8.84E-01</b> | 1.34E+00        | 1.44E+00 | 1.91E+00 | 1.43E+00        | <b>9.65E-01</b> |
| T <sub>31</sub> | 1.74E-01       | 2.69E-01 | 1.68E+03 | 4.86E-02        | <b>1.65E-04</b> | 1.07E+02        | 9.86E+01 | 1.50E+07 | 3.33E+01        | <b>2.96E+01</b> |
| T <sub>32</sub> | 4.87E+02       | 9.56E+01 | 1.00E+07 | 9.43E+01        | <b>2.33E+00</b> | 5.25E-01        | 5.28E-01 | 5.52E-01 | 4.43E-01        | <b>4.85E-04</b> |
| T <sub>33</sub> | 5.39E-01       | 5.29E-01 | 5.54E-01 | 4.99E-01        | <b>4.02E-04</b> | 2.51E+01        | 1.73E+01 | 3.53E+02 | 1.85E+01        | <b>5.60E+00</b> |
| T <sub>34</sub> | 2.29E+01       | 1.71E+01 | 4.79E+02 | 2.78E+01        | <b>6.32E+00</b> | 1.05E-02        | 1.88E-02 | 2.82E-01 | 8.66E-03        | <b>2.02E-04</b> |
| T <sub>35</sub> | 1.37E+00       | 1.40E+00 | 1.99E+00 | 1.45E+00        | <b>8.40E-01</b> | 1.42E+00        | 1.41E+00 | 1.78E+00 | 1.26E+00        | <b>9.28E-01</b> |
| T <sub>36</sub> | 1.13E-01       | 2.20E-01 | 7.72E+02 | 4.50E-02        | <b>1.64E-04</b> | 5.94E+01        | 9.33E+01 | 2.56E+07 | 4.70E+01        | <b>3.73E+01</b> |
| T <sub>37</sub> | 9.95E+01       | 5.63E+01 | 3.22E+07 | 4.35E+01        | <b>4.98E+00</b> | 5.25E-01        | 5.30E-01 | 5.54E-01 | 4.99E-01        | <b>2.89E-04</b> |
| T <sub>38</sub> | 5.26E-01       | 5.28E-01 | 5.53E-01 | 4.92E-01        | <b>3.36E-04</b> | 2.03E+01        | 1.88E+01 | 4.20E+02 | 2.26E+01        | <b>5.30E+00</b> |
| T <sub>39</sub> | 2.15E+01       | 1.98E+01 | 3.33E+02 | 2.28E+01        | <b>5.86E+00</b> | 1.09E-02        | 1.96E-02 | 4.07E-01 | 1.04E-02        | <b>2.18E-04</b> |
| T <sub>40</sub> | 1.39E+00       | 1.47E+00 | 1.91E+00 | 1.43E+00        | <b>1.02E+00</b> | 1.40E+00        | 1.45E+00 | 1.64E+00 | 1.43E+00        | <b>9.05E-01</b> |
| T <sub>41</sub> | 1.60E-01       | 2.77E-01 | 1.26E+03 | 5.24E-02        | <b>1.66E-04</b> | 6.49E+01        | 4.55E+02 | 1.38E+07 | 8.63E+01        | <b>1.97E+01</b> |
| T <sub>42</sub> | 8.50E+01       | 5.35E+01 | 2.03E+07 | 2.62E+01        | <b>2.32E+01</b> | 5.26E-01        | 5.28E-01 | 5.52E-01 | 5.03E-01        | <b>3.06E-04</b> |
| T <sub>43</sub> | 5.29E-01       | 5.30E-01 | 5.55E-01 | 5.20E-01        | <b>2.41E-04</b> | 2.42E+01        | 1.79E+01 | 4.04E+02 | 2.63E+01        | <b>5.02E+00</b> |
| T <sub>44</sub> | 2.37E+01       | 1.46E+01 | 3.76E+02 | 2.86E+01        | <b>6.32E+00</b> | 1.10E-02        | 1.79E-02 | 2.81E-01 | 8.29E-03        | <b>2.08E-04</b> |
| T <sub>45</sub> | 1.39E+00       | 1.44E+00 | 1.87E+00 | 1.45E+00        | <b>1.04E+00</b> | 1.38E+00        | 1.46E+00 | 1.92E+00 | 1.37E+00        | <b>9.13E-01</b> |
| T <sub>46</sub> | 1.54E-01       | 4.29E-01 | 1.60E+03 | 4.91E-02        | <b>1.64E-04</b> | 5.85E+02        | 3.86E+02 | 2.69E+07 | 1.72E+02        | <b>3.38E+00</b> |
| T <sub>47</sub> | 9.88E+01       | 5.82E+01 | 2.02E+07 | 1.93E+01        | <b>2.91E+00</b> | 5.30E-01        | 5.31E-01 | 5.55E-01 | 5.00E-01        | <b>9.08E-04</b> |
| T <sub>48</sub> | 5.35E-01       | 5.31E-01 | 5.54E-01 | 5.11E-01        | <b>8.03E-04</b> | 2.44E+01        | 1.56E+01 | 4.50E+02 | 2.66E+01        | <b>6.31E+00</b> |
| T <sub>49</sub> | 2.08E+01       | 1.61E+01 | 2.68E+02 | 2.03E+01        | <b>5.70E+00</b> | 1.20E-02        | 1.81E-02 | 3.90E-01 | 9.54E-03        | <b>2.03E-04</b> |
| T <sub>50</sub> | 1.47E+00       | 1.47E+00 | 1.83E+00 | 1.37E+00        | <b>9.03E-01</b> | 1.41E+00        | 1.40E+00 | 1.85E+00 | 1.44E+00        | <b>9.63E-01</b> |

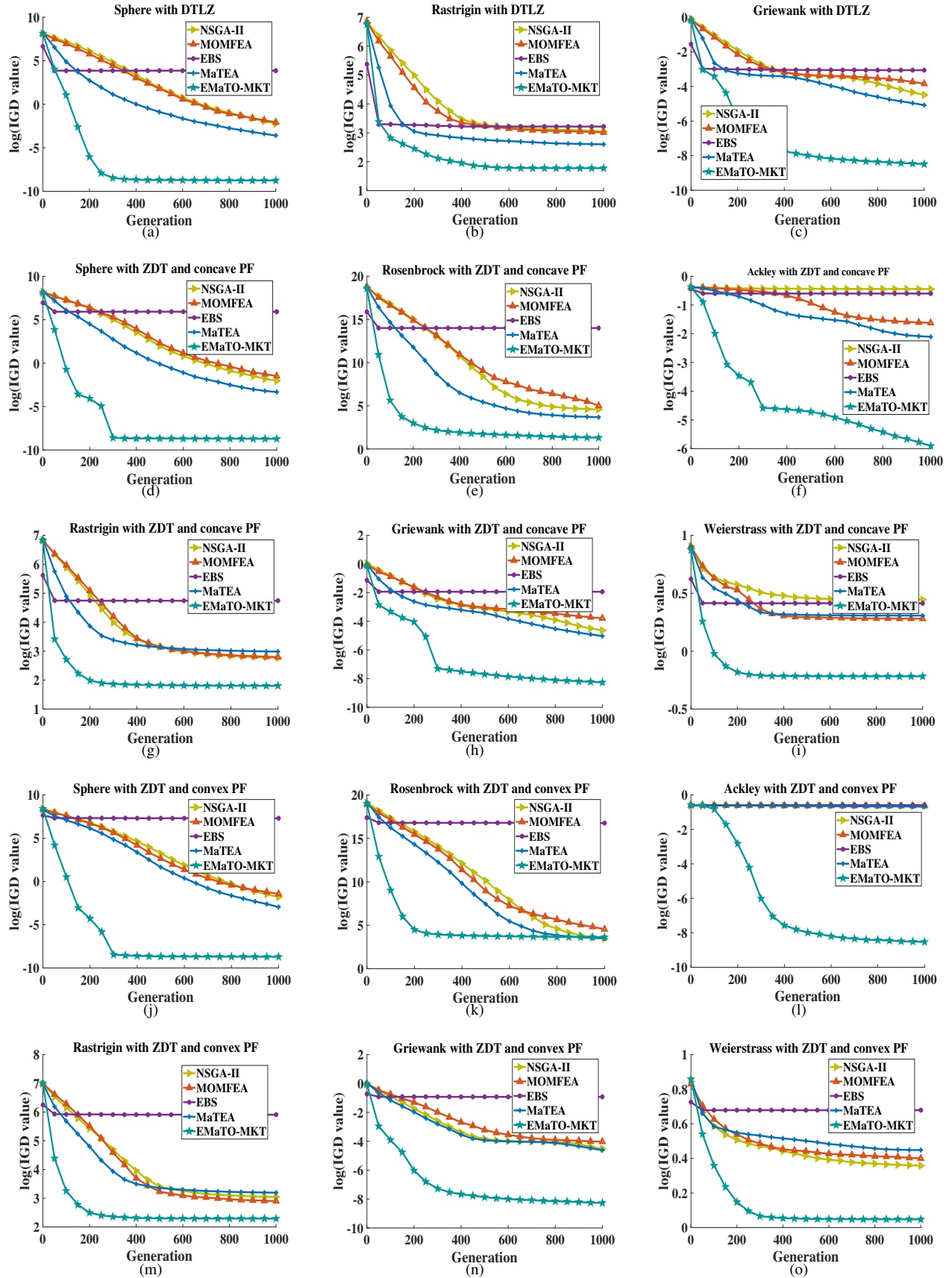


Fig. S4. The log(IGD) numerical curve of NSGA-II, MOMFEA, EBS, MaTEA and EMaTO-MKT running 30 times independently on 15 function combination in WCCI20-MOMATP test suite.