| 工件 | 工序 | 可用机器 | 可操作人员 | 熟练度等级 | 人员加工时间 | 人员成本 | 机器加工时间 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | 9 | 100 | 19 |
|  |  |  |  |  | 10 | 85 | 19 |
|  |  |  |  |  | 7 | 120 | 19 |
|  |  |  |  |  | 8 | 70 | 18 |
|  |  |  |  |  | 6 | 120 | 18 |
|  |  |  |  |  | 7 | 100 | 18 |
|  |  |  |  |  | 8 | 100 | 17 |
|  |  |  |  |  | 10 | 100 | 17 |
|  |  |  |  |  | 13 | 80 | 17 |
|  |  |  |  |  | 8 | 70 | 19 |
|  |  |  |  |  | 5 | 110 | 19 |
|  |  |  |  |  | 8 | 70 | 19 |
|  |  |  |  |  | 8 | 100 | 20 |
|  |  |  |  |  | 7 | 110 | 20 |
|  |  |  |  |  | 10 | 100 | 20 |
|  |  |  |  |  | 5 | 150 | 22 |
|  |  |  |  |  | 6 | 100 | 22 |
|  |  |  |  |  | 8 | 50 | 22 |
|  |  |  |  |  | 9 | 70 | 23 |
|  |  |  |  |  | 7 | 130 | 23 |
|  |  |  |  |  | 9 | 70 | 23 |
|  |  |  |  |  | 6 | 100 | 19 |
|  |  |  |  |  | 5 | 150 | 19 |
|  |  |  |  |  | 3 | 170 | 19 |
|  |  |  |  |  | 6 | 80 | 24 |
|  |  |  |  |  | 5 | 140 | 24 |
|  |  |  |  |  | 6 | 80 | 24 |
|  |  |  |  |  | 9 | 70 | 22 |
|  |  |  |  |  | 7 | 100 | 22 |
|  |  |  |  |  | 11 | 60 | 22 |
|  |  |  |  |  | 9 | 70 | 25 |
|  |  |  |  |  | 6 | 120 | 25 |
|  |  |  |  |  | 9 | 70 | 25 |
|  |  |  |  |  | 8 | 100 | 23 |
|  |  |  |  |  | 7 | 110 | 23 |
|  |  |  |  |  | 10 | 100 | 23 |
|  |  |  |  |  | 3 | 210 | 19 |
|  |  |  |  |  | 4 | 200 | 19 |
|  |  |  |  |  | 6 | 180 | 19 |
|  |  |  |  |  | 10 | 100 | 22 |
|  |  |  |  |  | 8 | 110 | 22 |
|  |  |  |  |  | 10 | 100 | 22 |
|  |  |  |  |  | 10 | 85 | 25 |
|  |  |  |  |  | 9 | 100 | 25 |
|  |  |  |  |  | 7 | 110 | 25 |
|  |  |  |  |  | 9 | 60 | 26 |
|  |  |  |  |  | 6 | 120 | 26 |
|  |  |  |  |  | 8 | 80 | 26 |
|  |  |  |  |  | 8 | 50 | 23 |
|  |  |  |  |  | 6 | 100 | 23 |
|  |  |  |  |  | 11 | 50 | 23 |
|  |  |  |  |  | 8 | 50 | 19 |
|  |  |  |  |  | 5 | 150 | 19 |
|  |  |  |  |  | 8 | 50 | 19 |
|  |  |  |  |  | 7 | 60 | 21 |
|  |  |  |  |  | 6 | 120 | 21 |
|  |  |  |  |  | 9 | 90 | 21 |
|  |  |  |  |  | 7 | 110 | 18 |
|  |  |  |  |  | 8 | 100 | 18 |
|  |  |  |  |  | 10 | 100 | 18 |
|  |  |  |  |  | 8 | 10 | 21 |
|  |  |  |  |  | 6 | 100 | 21 |
|  |  |  |  |  | 8 | 50 | 21 |

表3 算法参数

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **参数** | 种群大小 | 迭代次数 | 交叉率 | 变异率 | 局部搜索概率 | 纳什均衡系数 | 线程数 |
| **数值** | 100 | 150 | 0.4 | 0.2 | 0.2 | 0.3 | 3 |

表2 人员疲劳度数据

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| 人员 |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |