オペレーティングシステム中間課題

2023 年 2 月 6 日

1　プログラムの説明

1.1　作成したプログラム

哲学者の食事問題を解くプログラムを作成した.

1.2　クリティカルセクションと排他制御について行ったこと

今回作成したプログラムでは，フォークをリソースとして，哲学者がリソースを使用するという形になっている．哲学者がフォークを取得する部分をクリティカルセッションとしていて，優先で取得できるフォークがすでに取得されている場合は使用可能になるまで待機状態になる.

本プログラムで排他制御を行わなかった場合，それぞれの哲学者は以下のように振る舞う.

1. 左のフォークが得られるまで思考し，フォークを取得する.
2. 右のフォークが得られるまで思考し，フォークを取得する.
3. 食事をする．(1 5 秒のランダムな時間待機)
4. 右のフォークを置く.
5. 左のフォークを置く.

この場合，全哲学者が左のフォークを持ち，右のフォークが得られなくなるのでデットロック状態になる.

この問題の解決方法として,

2　動作環境

表 1　動作環境

OS	ubuntu22.04 LTS
CPU	Intel® Core™ i7-8700K CPU @ 3.70GHz × 12
メモリ	32.0GB
コンパイラ	g++ version 11.3.0
使用言語	C++17

3　実行手順

プログラムのコンパイルコマンドを以下に示す.

1　コンパイル

```
1       g++ -Wall main.cpp -pthread -std=c++17
```

以下のコマンドで実行した.

2　実行コマンド

```
1       ./a.out
```

4　実行結果

ループ数 3 で哲学者が 5 人の条件でプログラムの実行したときの結果を以下に示す.

3　実行結果

```
1       f11@desktop-f11<TUThumbleERv3>:~/Git/The_edining_philosophers$ ./a.out
2       start
3       Philosopher 1 is reading..
4       Philosopher 2 is reading..
5       Philosopher1 thinking
6       Philosopher 3 is reading..
7       Philosopher 4 is reading..
8       Philosopher 5 is reading..
9       Philosopher3 thinking
10      Philosopher4 thinking
11      PhilosopherPhilosopher5 thinking
12      2 thinking
13      Philosopher4 get fork4 DONE
14      Philosopher4 get fork3 DONE
15      Philosopher4 is eating
16      Philosopher1 get fork5 DONE
17      Philosopher1 get fork1 DONE
18      Philosopher1 is eating
19      Philosopher3 get fork2 DONE
20      Philosopher3 get fork3Philosopher4 has finished eating
21      Philosopher4 put fork3 DONE
22      Philosopher4 put fork4 DONE
23      Philosopher4 thinking
24      DONE
25      Philosopher3 is eating
26      Philosopher5 get fork4 DONE
27      Philosopher5 get fork5Philosopher2 get fork2Philosopher3 has finished eating
28      Philosopher3 put fork3 DONE
29      Philosopher3 put fork2 DONE
30      Philosopher3 thinking
31      DONE
32      Philosopher2 get fork1Philosopher1 has finished eating
33      Philosopher1 put fork1 DONE
34      Philosopher1 put fork5 DONE
35      Philosopher1 thinking
36      DONE
37      Philosopher2 is eating
```

```
38          DONE
39          Philosopher5 is eating
40          Philosopher4 get fork4Philosopher3 get fork2Philosopher1 get
                fork5PhilosopherPhilosopher5 has finished eating
41          Philosopher5 put fork5 DONE
42          Philosopher5 put fork4 DONE
43          Philosopher5 thinking
44          DONE
45          Philosopher4 get fork3 DONE
46          Philosopher4 is eating
47          DONE
48          Philosopher1 get fork12 has finished eating
49          Philosopher2 put fork1 DONE
50          Philosopher2 put fork2 DONE
51          Philosopher2 thinking
52          DONE DONE
53          Philosopher1 is eating
54
55          Philosopher3 get fork3Philosopher4 has finished eating
56          Philosopher4 put fork3 DONE
57          Philosopher4 put fork4 DONE
58          Philosopher4 thinking
59          DONE
60          Philosopher3 is eating
61          Philosopher1 has finished eating
62          Philosopher1 put fork1 DONE
63          Philosopher1 put fork5 DONE
64          Philosopher1 thinking
65          Philosopher4 get fork4 DONE
66          Philosopher4 get fork3Philosopher5 get fork4Philosopher3 has finished eating
67          Philosopher3 put fork3 DONE
68          Philosopher3 put fork2 DONE
69          Philosopher3 thinking
70          Philosopher1 get fork5 DONE
71          Philosopher1 get fork1 DONE
72          Philosopher1 is eating
73          DONE
74          Philosopher4 is eating
75          Philosopher2 get fork2 DONE
76          Philosopher2 get fork1Philosopher4 has finished eating
77          Philosopher4 put fork3 DONE
78          Philosopher4 put fork4 DONE
79          DONE
80          Philosopher5 get fork5Philosopher1 has finished eating
81          Philosopher1 put fork1 DONE
82          Philosopher1 put fork5 DONE
83          DONE
84          Philosopher2 is eating
85          DONE
86          Philosopher5 is eating
```

```
87          Philosopher2 has finished eating
88          Philosopher2 put fork1 DONE
89          Philosopher2 put fork2 DONE
90          Philosopher2 thinking
91          Philosopher3 get fork2 DONE
92          Philosopher3 get fork3 DONE
93          Philosopher3 is eating
94          Philosopher5 has finished eating
95          Philosopher5 put fork5 DONE
96          Philosopher5 put fork4 DONE
97          Philosopher5 thinking
98          Philosopher5 get fork4 DONE
99          Philosopher5 get fork5 DONE
100         Philosopher5 is eating
101         Philosopher2 get fork2Philosopher3 has finished eating
102         Philosopher3 put fork3 DONE
103         Philosopher3 put fork2 DONE
104         DONE
105         Philosopher2 get fork1 DONE
106         Philosopher2 is eating
107         Philosopher2 has finished eating
108         Philosopher2 put fork1 DONE
109         Philosopher2 put fork2 DONE
110         Philosopher5 has finished eating
111         Philosopher5 put fork5 DONE
112         Philosopher5 put fork4 DONE
113         finish
```

5 工夫した点・感想

6 参考文献

参考文献

[1] Akira Takahashi ,” std::thread”,cpprefjp - C++ 日本語リファレンス,https://cpprefjp.github.io/reference/thread/thread.html,2022 年 11 月 29 日.