

Homework #6

[ECE30021/ITP30002] Operating Systems

Mission



■ Solve problem 1 and 2

- Solve the problems on Ubuntu Linux (VirtualBox or UTM) using vim and gcc.
- Problem 1 is a group assignment but Problem 2 is not.
 - Using AI is allowed for Problem 1 but not for Problem 2

■ Submission

- Submit a .tgz file containing hw6_1.c and hw6_2.c on LMS.
“tar cvfz hw6_<student_id>.tgz hw6_1.c hw6_2.c”
(Do not copy&past but type the above command.)
- After compression, please check the .tgz file by decompressing in an empty directory.
“tar xvfz hw6_<student_id>.tgz”

■ Due date: PM 11:00:00, May 23rd

Honor Code Guidelines

■ “과제”

- 과제는 교과과정의 내용을 소화하여 실질적인 활용 능력을 갖추기 위한 교육활동이다. 학생은 모든 과제를 정직하고 성실하게 수행함으로써 과제에 의도된 지식과 기술을 얻기 위해 최선을 다해야 한다.
- 제출된 과제물은 성적 평가에 반영되므로 공식적으로 허용되지 않은 자료나 도움을 획득, 활용, 요구, 제공하는 것을 포함하여 평가의 공정성에 영향을 미치는 모든 형태의 부정행위는 단호히 거부해야 한다.
- 수업 내용, 공지된 지식 및 정보, 또는 과제의 요구를 이해하기 위하여 동료의 도움을 받는 것은 부정행위에 포함되지 않는다. 그러나, 과제를 해결하기 위한 모든 과정은 반드시 스스로의 힘으로 수행해야 한다.
- 담당교수가 명시적으로 허락한 경우를 제외하고 다른 사람이 작성하였거나 인터넷 등에서 획득한 과제물, 또는 프로그램 코드의 일부, 또는 전체를 이용하는 것은 부정행위에 해당한다.
- 자신의 과제물을 타인에게 보여주거나 빌려주는 것은 공정한 평가를 방해하고, 해당 학생의 학업 성취를 저해하는 부정행위에 해당한다.
- 팀 과제가 아닌 경우 두 명 이상이 함께 과제를 수행하여 이를 개별적으로 제출하는 것은 부정행위에 해당한다.
- 스스로 많은 노력을 한 후에도 버그나 문제점을 파악하지 못하여 동료의 도움을 받는 경우도 단순한 문법적 오류에 그쳐야 한다. 과제가 요구하는 design, logic, algorithm의 작성에 있어서 담당교수, TA, tutor 이외에 다른 사람의 도움을 받는 것은 부정행위에 해당한다.
- 서로 다른 학생이 제출한 제출물간 유사도가 통상적으로 발생할 수 있는 정도를 크게 넘어서는 경우, 또는 자신이 제출한 과제물에 대하여 구체적인 설명을 하지 못하는 경우에는 부정행위로 의심받거나 판정될 수 있다.

Problem 1



- Mission: peer review of midterm problems **as a group**
 - Sign up study group
 - Section 01:
https://docs.google.com/spreadsheets/d/1fIRP_15xVKxahA6bGDeifoBvW2upYjgkyi6eU0ch4MQ/edit?usp=sharing
 - Section 02:
https://docs.google.com/spreadsheets/d/1JovWOMVhmVbF2A74NX_T7uXxEZrC-oRXlgHeK9r53tQ/edit?usp=sharing
 - Have a meeting to review HW#5
 - Review the solutions of other members and share comments to each other.
 - Each member update her/his solution to hw5_2 individually applying the comments.
 - Mark the modified parts by comments as the next page.
 - If you believe your previous solution was perfect, submit it again and put a comment “My previous solution was perfect, so I didn't modify it!” in the first line.
 - Review all midterm problems but submit only the updated solution to hw5_2.

Problem 1



- Example of updated solution.

```
int main()
{
    int i = 0;

    // previous code
    /*
    <old code>

    */

    // updated code
    <new code>

    return 0;
}
```

Problem 2



- Search the Internet for the following functions and learn how to use mutex and semaphore.
 - Mutex (pthread_mutex_t) functions
 - pthread_mutex_init(), pthread_mutex_destroy()
 - pthread_mutex_lock(), pthread_mutex_unlock()
 - Semaphore (sem_t) functions
 - sem_open(), sem_close(), sem_unlink() // for named semaphores
 - sem_init(), sem_destroy() // for unnamed semaphores
 - sem_wait(), sem_post()

Problem 2



- Implement the producer–consumer solution using `pthread_mutex_t` and `sem_t`.
 - Main
 - Launch producer and consumer threads
 - Producer
 - Periodically produces a text message and insert it into the buffer
 - Consumer
 - Periodically delete a text message from the buffer and displays it
 - Follow the instructions in `hw6_2_problem.c`

Problem 2



■ Example) ./hw6_2 1 2 10 // the producer is faster than the consumer

```
producer_delay = 1, consumer_delay = 2, duration = 10
[producer] created a message [Boys, be ambitious for Christ!].
[producer] inserted message into the buffer (count = 1) [Boys, be ambitious for Christ!].
[consumer] deleted message from the buffer (count = 0) [Boys, be ambitious for Christ!].
[consumer] consuming message [Boys, be ambitious for Christ!].
[producer] created a message [Blessed are those who are persecuted because of righteousness, for theirs is the kingdom of heaven.].
[producer] inserted message into the buffer (count = 1) [Blessed are those who are persecuted because of righteousness, for theirs is the kingdom of heaven.].
[consumer] deleted message from the buffer (count = 0) [Blessed are those who are persecuted because of righteousness, for theirs is the kingdom of heaven.].
[consumer] consuming message [Blessed are those who are persecuted because of righteousness, for theirs is the kingdom of heaven.].
[producer] created a message [Boys, be ambitious for Christ!].
[producer] inserted message into the buffer (count = 1) [Boys, be ambitious for Christ!].
[producer] created a message [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[producer] inserted message into the buffer (count = 2) [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[consumer] deleted message from the buffer (count = 1) [Boys, be ambitious for Christ!].
[consumer] consuming message [Boys, be ambitious for Christ!].
[producer] created a message [Blessed are the peacemakers, for they will be called sons of God.].
[producer] inserted message into the buffer (count = 2) [Blessed are the peacemakers, for they will be called sons of God.].
[producer] created a message [Blessed are the peacemakers, for they will be called sons of God.].
[producer] inserted message into the buffer (count = 3) [Blessed are the peacemakers, for they will be called sons of God.].
[consumer] deleted message from the buffer (count = 2) [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[consumer] consuming message [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[producer] created a message [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[producer] inserted message into the buffer (count = 3) [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[producer] created a message [Blessed are those who hunger and thirst for righteousness, for they will be filled.].
[consumer] deleted message from the buffer (count = 2) [Blessed are the peacemakers, for they will be called sons of God.].
[consumer] consuming message [Blessed are the peacemakers, for they will be called sons of God.].
[producer] inserted message into the buffer (count = 3) [Blessed are those who hunger and thirst for righteousness, for they will be filled.].
[producer] created a message [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
[main] Deleting a string to signal the producer.
[producer] inserted message into the buffer (count = 3) [Blessed are the poor in spirit, for theirs is the kingdom of heaven.].
Destroying mutex and semaphores
Bye!
```


Problem 2

- Exmple2) hw6_2 2 1 10 // the consumer is faster than the producer

```
producer_delay = 2, consumer_delay = 1, duration = 10
[producer] created a message [Boys, be ambitious for Christ!].
[producer] inserted message into the buffer (count = 1) [Boys, be ambitious for Christ!].
    [consumer] deleted message from the buffer (count = 0) [Boys, be ambitious for Christ!].
    [consumer] consuming message [Boys, be ambitious for Christ!].
[producer] created a message [Boys, be ambitious for Christ!].
[producer] inserted message into the buffer (count = 1) [Boys, be ambitious for Christ!].
    [consumer] deleted message from the buffer (count = 0) [Boys, be ambitious for Christ!].
    [consumer] consuming message [Boys, be ambitious for Christ!].
[producer] created a message [Blessed are the meek, for they will inherit the earth.].
[producer] inserted message into the buffer (count = 1) [Blessed are the meek, for they will inherit the earth.].
    [consumer] deleted message from the buffer (count = 0) [Blessed are the meek, for they will inherit the earth.].
    [consumer] consuming message [Blessed are the meek, for they will inherit the earth.].
[producer] created a message [Blessed are the meek, for they will inherit the earth.].
[producer] inserted message into the buffer (count = 1) [Blessed are the meek, for they will inherit the earth.].
    [consumer] deleted message from the buffer (count = 0) [Blessed are the meek, for they will inherit the earth.].
    [consumer] consuming message [Blessed are the meek, for they will inherit the earth.].
[producer] created a message [Never give up!].
[producer] inserted message into the buffer (count = 1) [Never give up!].
    [consumer] deleted message from the buffer (count = 0) [Never give up!].
    [consumer] consuming message [Never give up!].
[main] Inserting a dummy string to signal the consumer.
    [consumer] deleted message from the buffer (count = 0) [Dummy].
    [consumer] consuming message [Dummy].
Destroying mutex and semaphores
Bye!
```