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Introduction

In this assignment, I have implemented a solution to the Reader-Writer problem with password authentication using threads and semaphores. The program creates real and dummy reader and writer threads, each requiring a unique password from a table to access a global variable buffer (BUFFER). The buffer is shared among all threads, with synchronization mechanisms ensuring proper access control and preventing race conditions.

Test Results

Test Case 1: 2 Readers and 2 Writers

```
harunugurlu@DESKTOP-N29F8H2:/mnt/c/Users/harun/Projects/cmpe382/hw3$ ./rw 2 2
Thread No   Validity(real/dummy)   Role(reader/writer)   Value read/written
2       real        reader      -1
0       real        reader      -1
3       dummy       reader      -1
4       real        writer      3185
5       dummy       writer      -1
6       real        writer      7279
1       dummy       reader      -1
7       dummy       writer      -1
6       real        writer      6131
1       dummy       reader      -1
4       real        writer      6295
7       dummy       writer      -1
5       dummy       writer      -1
3       dummy       reader      -1
0       real        reader      3185
2       real        reader      6295
1       dummy       reader      -1
6       real        writer      4820
4       real        writer      8974
7       dummy       writer      -1
5       dummy       writer      -1
3       dummy       reader      -1
0       real        reader      4820
2       real        reader      7279
1       dummy       reader      -1
6       real        writer      4261
7       dummy       writer      -1
4       real        writer      9817
5       dummy       writer      -1
3       dummy       reader      -1
0       real        reader      8974
2       real        reader      4261
7       dummy       writer      -1
6       real        writer      3121
1       dummy       reader      -1
5       dummy       writer      -1
3       dummy       reader      -1
4       real        writer      5603
0       real        reader      3121
2       real        reader      9817
```

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Test Case 2: 5 Readers and 5 Writers

```
harunugurlu@DESKTOP-N29F8H2:/mnt/c/Users/harun/Projects/cmpe382/hw3$ ./rw 5 5
Thread No   Validity(real/dummy)   Role(reader/writer)   Value read/written
0       real        reader      -1
1       dummy       reader      -1
2       real        reader      -1
4       real        reader      -1
5       dummy       reader      -1
6       real        reader      -1
3       dummy       reader      -1
8       real        reader      -1
9       dummy       reader      -1
7       dummy       reader      -1
15      dummy       writer      -1
19      dummy       writer      -1
10      real        writer      5622
12      real        writer      4818
13      dummy       writer      -1
11      dummy       writer      -1
17      dummy       writer      -1
14      real        writer      9740
16      real        writer      7992
18      real        writer      8565
0       real        reader      5622
5       dummy       reader      -1
1       dummy       reader      -1
6       real        reader      4818
7       dummy       reader      -1
19      dummy       writer      -1
9       dummy       reader      -1
8       real        reader      5622
13      dummy       writer      -1
15      dummy       writer      -1
17      dummy       writer      -1
11      dummy       writer      -1
4       real        reader      7992
2       real        reader      5622
18      real        writer      8778
10      real        writer      5394
12      real        writer      1135
14      real        writer      6856
3       dummy       reader      -1
16      real        writer      2033
1       dummy       reader      -1
13      dummy       writer      -1
6       real        reader      6856
0       real        reader      4818
7       dummy       reader      -1
8       real        reader      9740
5       dummy       reader      -1
```

```
9       dummy       reader      -1
19      dummy       writer      -1
15      dummy       writer      -1
17      dummy       writer      -1
11      dummy       writer      -1
2       real        reader      9740
4       real        reader      4818
18      real        writer      2854
10      real        writer      7864
12      real        writer      8968
3       dummy       reader      -1
14      real        writer      3500
16      real        writer      9964
1       dummy       reader      -1
19      dummy       writer      -1
15      dummy       writer      -1
17      dummy       writer      -1
7       dummy       reader      -1
5       dummy       reader      -1
11      dummy       writer      -1
13      dummy       writer      -1
9       dummy       reader      -1
3       dummy       reader      -1
2       real        reader      9740
6       real        reader      1135
4       real        reader      2033
8       real        reader      9740
0       real        reader      5622
18      real        writer      2051
10      real        writer      7386
14      real        writer      6844
12      real        writer      8143
16      real        writer      2730
1       dummy       reader      -1
15      dummy       writer      -1
7       dummy       reader      -1
17      dummy       writer      -1
2       real        reader      4818
19      dummy       writer      -1
11      dummy       writer      -1
13      dummy       writer      -1
5       dummy       reader      -1
9       dummy       reader      -1
3       dummy       reader      -1
4       real        reader      6856
6       real        reader      7992
8       real        reader      9740
0       real        reader      7386
18      real        writer      5291
10      real        writer      2140
14      real        writer      8790
12      real        writer      5426
16      real        writer      5348
```

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Test Case 3: 3 Readers and 4 Writers

```
● harunugurlu@DESKTOP-N29F8H2:/mnt/c/Users/harun/Projects/cmpe382/hw3$ ./rw 3 4
  Thread No   Validity(real/dummy)   Role(reader/writer)   Value read/written
  0      real      reader      -1
  2      real      reader      -1
  1      dummy     reader      -1
  6      real      writer     3407
  3      dummy     reader      -1
  4      real      reader     3407
  5      dummy     reader      -1
  9      dummy     writer      -1
  13     dummy     writer      -1
  8      real      writer     5637
  12     real      writer     2327
  7      dummy     writer      -1
  10     real      writer     8255
  11     dummy     writer      -1
  13     dummy     writer      -1
  9      dummy     writer      -1
  11     dummy     writer      -1
  10     real      writer     5197
  3      dummy     reader      -1
  5      dummy     reader      -1
  7      dummy     writer      -1
  1      dummy     reader      -1
  6      real      writer     3465
  12     real      writer     7152
  4      real      reader     2327
  8      real      writer     8436
  2      real      reader     5637
  0      real      reader     8436
  7      dummy     writer      -1
  1      dummy     reader      -1
  11     dummy     writer      -1
  3      dummy     reader      -1
  5      dummy     reader      -1
  9      dummy     writer      -1
  13     dummy     writer      -1
  10     real      writer     3512
  6      real      writer     6398
  12     real      writer     7574
  8      real      writer     6325
  4      real      reader     5197
  0      real      reader     3407
  2      real      reader     8436
  7      dummy     writer      -1
  1      dummy     reader      -1
  11     dummy     writer      -1
  3      dummy     reader      -1
  5      dummy     reader      -1
  9      dummy     writer      -1
  6      real      writer     9308
  13     dummy     writer      -1
  10     real      writer     9349
  12     real      writer     1848
```

```
  8      real      writer     8774
  4      real      reader     6325
  0      real      reader     5197
  2      real      reader     5197
  1      dummy     reader      -1
  7      dummy     writer      -1
  9      dummy     writer      -1
  3      dummy     reader      -1
  5      dummy     reader      -1
  13     dummy     writer      -1
  10     real      writer     2797
  11     dummy     writer      -1
  12     real      writer     6155
  6      real      writer     6574
  8      real      writer     1766
  4      real      reader     1848
  0      real      reader     2327
  2      real      reader     7574
```