

# lab3 test&review

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## Task 1 Sleeping Barber Problem

### 1、代码说明

#### ① 类的定义

```
1  class barberCustomerMonitor
2      superclass Object
3      fields
4          customers: Semaphore
5          barbers: Semaphore
6          mutex: Semaphore
7          waiting: int
8
9      --need a queue to sort the customer who is waiting
10     q: array [CHAIRS] of int
11     --front of the queue
12     qf: int
13     -- rear of the queue
14     qr: int
15
16     methods
17         Init()
18         barber_behave(id: int)
19         customer_behave(id: int)
20         cut_hair(id: int)
21         get_haircut(id: int)
22     endClass
```

- customers、barbers、mutex：信号量
- waiting：表示正坐在椅子上等待理发的顾客
- q：在barber\_behave()函数中，barber理发时需要**按顺序**将正在理发的顾客的id输出。所以需要一  
个队列。
- qf：队列的头；qr：队列的尾
- 函数作用在下文讲述。

#### ② 各个函数的作用

- Init() 略
- barber\_behave(id: int)

- ```

1      method barber_behave(id: int)
2          while true
3              customers.Down()
4              mutex.Down()
5              waiting = waiting - 1
6              barbers.Up()
7              mutex.Up()
8
9              self.cut_hair(id)
10
11          endwhile
12      endMethod

```

- 首先进行P关系的变化customers.Down()【此时若没有顾客，barber将会sleep，直到有第一个顾客来到并执行customers.Up()后才会唤醒barber】，然后上锁，对waiting进行-1操作表示当前顾客已经理发完毕；随后barbers.Up()，解锁。此时上一个顾客已经完毕，即将被下一个顾客的线程进行barbers.Down()以开始理发，所以此时我们应该在cut\_hair()输出即将理发的顾客的信息。

- cut\_hair(id: int)

- ```

1      method cut_hair(id: int)
2          print("The barber is cutting hair for customer ")
3          printInt(q[qf])
4          print("\n")
5
6          qf = (qf+1) % CHAIRS
7
8      endMethod

```

- cut\_hair()函数主要进行输出下一个顾客的理发信息，并更新队列。

- customer\_behave(id: int)

- ```

1      method customer_behave(id: int)
2
3          mutex.Down()
4
5          if waiting < CHAIRS
6              print("customer ")
7              printInt (id)
8              print (" is waiting, ")
9
10             waiting = waiting + 1
11             q[qr] = id
12             qr = (qr+1) % CHAIRS
13
14
15             printInt(5 - waiting)
16             print(" chair(s) left \n")
17
18             customers.Up()
19             mutex.Up()
20             barbers.Down()
21
22             -- cutting time, not necessary to use
23             --self.get_haircut(id)

```

```

24
25     else
26         print("The customer ")
27         printInt(id)
28         print(" is leaving since no chair to sit\n")
29         mutex.Up()
30
31     endIf
32 endMethod

```

- 首先需要上锁。随后判断是否有空闲的位置，如果有则输出入座等待的信息并更新waiting和队列。随后输出还有多少椅子空闲。因为**我们需要在确定顾客是否入座，之后才能执行barbers.Down()**，所以需要在customers.Up()和mutex.Up()后才执行barbers.Down()。而如果此时barber如果忙碌，该线程将会sleep，直到信号量barbers内的队列中轮到该线程了，才会被唤醒并开始理发。开始理发后执行get\_haircut()函数，所以该函数需要体现理发时间。
- get\_haircut(id:int)

```

1      method get_haircut(id:int)
2      var
3          i:int
4          -- during cutting
5          mutex.Down()
6          for i = 0 to 5
7              currentThread.Yield()
8          endFor
9          mutex.Up()
10
11
12      endMethod

```

- 为了保证在理发过程中其他线程不会被唤醒，所以我们需要上锁。由于理发时，当前处于ready态的顾客线程只有这一个，其他顾客都在睡眠，处于barbers.Down()的等待队列中，所以currentThread.Yield()的作用仅仅只是消耗时间。

## 2、输出

没有设置cutting\_time，即没有执行get\_haircut(id)的情况：

```
harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$ blitz -g os
Beginning execution...
===== KPL PROGRAM STARTING =====
Initializing Thread Scheduler...
customer 1 is waiting, 4 chair(s) left
customer 2 is waiting, 3 chair(s) left
customer 3 is waiting, 2 chair(s) left
The barber is cutting hair for customer 1
The barber is cutting hair for customer 2
The barber is cutting hair for customer 3
customer 4 is waiting, 4 chair(s) left
customer 5 is waiting, 3 chair(s) left
customer 6 is waiting, 2 chair(s) left
The barber is cutting hair for customer 4
customer 7 is waiting, 2 chair(s) left
customer 8 is waiting, 1 chair(s) left
customer 9 is waiting, 0 chair(s) left
The customer 10 is leaving since no chair to sit
The barber is cutting hair for customer 5
customer 11 is waiting, 0 chair(s) left
The customer 12 is leaving since no chair to sit
The customer 13 is leaving since no chair to sit
The customer 14 is leaving since no chair to sit
The barber is cutting hair for customer 6
customer 15 is waiting, 0 chair(s) left
The customer 16 is leaving since no chair to sit
The customer 17 is leaving since no chair to sit
The customer 18 is leaving since no chair to sit
The customer 19 is leaving since no chair to sit
The customer 20 is leaving since no chair to sit
The barber is cutting hair for customer 7
customer 21 is waiting, 0 chair(s) left
The customer 22 is leaving since no chair to sit
The customer 23 is leaving since no chair to sit
The customer 24 is leaving since no chair to sit
The customer 25 is leaving since no chair to sit
The customer 26 is leaving since no chair to sit
The customer 27 is leaving since no chair to sit
The barber is cutting hair for customer 8
customer 28 is waiting, 0 chair(s) left
The customer 29 is leaving since no chair to sit
The customer 30 is leaving since no chair to sit
```

```
The customer 31 is leaving since no chair to sit
The customer 32 is leaving since no chair to sit
The customer 33 is leaving since no chair to sit
The customer 34 is leaving since no chair to sit
The customer 35 is leaving since no chair to sit
The customer 36 is leaving since no chair to sit
The barber is cutting hair for customer 9
customer 37 is waiting, 0 chair(s) left
The customer 38 is leaving since no chair to sit
The customer 39 is leaving since no chair to sit
The customer 40 is leaving since no chair to sit
The customer 41 is leaving since no chair to sit
The customer 42 is leaving since no chair to sit
The customer 43 is leaving since no chair to sit
The customer 44 is leaving since no chair to sit
The customer 45 is leaving since no chair to sit
The customer 46 is leaving since no chair to sit
The customer 47 is leaving since no chair to sit
The barber is cutting hair for customer 11
customer 48 is waiting, 0 chair(s) left
The customer 49 is leaving since no chair to sit
The customer 50 is leaving since no chair to sit
The barber is cutting hair for customer 15
The barber is cutting hair for customer 21
The barber is cutting hair for customer 28
The barber is cutting hair for customer 37
The barber is cutting hair for customer 48

**** A 'wait' instruction was executed and no more interrupts are scheduled... halting emulation! ****

Done! The next instruction to execute will be:
000EC8: 09000000      ret
Number of Disk Reads   = 0
Number of Disk Writes  = 0
Instructions Executed   = 303442
Time Spent Sleeping    = 0
    Total Elapsed Time = 303442
harryovo@harryovo-virtual-machine:~/Desktop/lab3/osa122/labs/lab3$
```

有理发时间，即执行get\_haircut(id)的情况：

```
harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$ blitz -g os
Beginning execution...
===== KPL PROGRAM STARTING =====
Initializing Thread Scheduler...
customer 1 is waiting, 4 chair(s) left
customer 2 is waiting, 3 chair(s) left
customer 3 is waiting, 2 chair(s) left
The barber is cutting hair for customer 1
The barber is cutting hair for customer 2
The barber is cutting hair for customer 3
customer 4 is waiting, 4 chair(s) left
customer 5 is waiting, 3 chair(s) left
customer 6 is waiting, 2 chair(s) left
The barber is cutting hair for customer 4
customer 7 is waiting, 2 chair(s) left
customer 8 is waiting, 1 chair(s) left
customer 9 is waiting, 0 chair(s) left
The customer 10 is leaving since no chair to sit
The customer 11 is leaving since no chair to sit
The customer 12 is leaving since no chair to sit
The customer 13 is leaving since no chair to sit
The customer 14 is leaving since no chair to sit
The customer 15 is leaving since no chair to sit
The customer 16 is leaving since no chair to sit
The customer 17 is leaving since no chair to sit
The customer 18 is leaving since no chair to sit
The customer 19 is leaving since no chair to sit
The customer 20 is leaving since no chair to sit
The customer 21 is leaving since no chair to sit
The customer 22 is leaving since no chair to sit
The customer 23 is leaving since no chair to sit
The customer 24 is leaving since no chair to sit
The customer 25 is leaving since no chair to sit
The customer 26 is leaving since no chair to sit
The customer 27 is leaving since no chair to sit
The customer 28 is leaving since no chair to sit
The customer 29 is leaving since no chair to sit
The customer 30 is leaving since no chair to sit
The customer 31 is leaving since no chair to sit
The customer 32 is leaving since no chair to sit
```

```

The customer 33 is leaving since no chair to sit
The customer 34 is leaving since no chair to sit
The customer 35 is leaving since no chair to sit
The customer 36 is leaving since no chair to sit
The barber is cutting hair for customer 5
customer 37 is waiting, 0 chair(s) left
The customer 38 is leaving since no chair to sit
The customer 39 is leaving since no chair to sit
The customer 40 is leaving since no chair to sit
The customer 41 is leaving since no chair to sit
The customer 42 is leaving since no chair to sit
The customer 43 is leaving since no chair to sit
The customer 44 is leaving since no chair to sit
The customer 45 is leaving since no chair to sit
The customer 46 is leaving since no chair to sit
The customer 47 is leaving since no chair to sit
The customer 48 is leaving since no chair to sit
The customer 49 is leaving since no chair to sit
The customer 50 is leaving since no chair to sit
The barber is cutting hair for customer 6
The barber is cutting hair for customer 7
The barber is cutting hair for customer 8
The barber is cutting hair for customer 9
The barber is cutting hair for customer 37

***** A 'wait' instruction was executed and no more interrupts are scheduled... halting emulation! *****

Done! The next instruction to execute will be:
000EC8: 09000000      ret
Number of Disk Reads   = 0
Number of Disk Writes  = 0
Instructions Executed   = 441870
Time Spent Sleeping    = 0
    Total Elapsed Time = 441870
harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$

```

显然，有理发时间的情况比没有理发时间的情况，成功理发的顾客要多。符合预期。

## Task 2 The Gaming Parlor Problem

### 1、代码说明

#### ① 类的定义

```

1      class gamingParlorMonitor
2          superclass Object
3          fields
4
5              -- dices left
6              dice_avail: int
7              mutex: Mutex
8
9              -- to ensure that have only 1 thread in while_
10             wait_: Condition
11             wait_count: int
12
13             -- whether the dices are enough

```

```

14         dice_not_enough: Condition
15
16
17
18     methods
19         Init()
20         Request(number_of_dice: int)
21         Return(number_of_dice: int)
22         Print(str: String, count: int)
23     endClass

```

- dice\_avail: 剩余的骰子
- mutex: 锁
- wait\_: 用来**保证按照顺序给出骰子，不会进入饥饿状态的条件变量**：保证每一次只会有一个线程进入询问骰子的while内。下文会详细讲述。
- wait\_count: 用来记录当前是否有多于1个线程在等待取骰子。
- dice\_not\_enough: 条件变量，用来标志当前骰子不足。

## ② 各个函数的作用

- Init() 略
- Request(number\_of\_dice: int)

```

○ 1     method Request(number_of_dice: int)
2         mutex.Lock()
3         self.Print ("requests", number_of_dice)
4
5
6
7         wait_count = wait_count + 1
8         if wait_count > 1
9             wait_.wait(&mutex)
10        endif
11
12
13        while dice_avail < number_of_dice
14            -- dice is not enough
15            dice_not_enough.wait(&mutex)
16        endwhile
17
18        -- dice is enough now
19        dice_avail = dice_avail - number_of_dice
20
21        wait_count = wait_count - 1
22        wait_.Signal(&mutex)
23
24        self.Print("proceeded with", number_of_dice)
25        mutex.Unlock()
26
27    endMethod
28
29
30    method Return(number_of_dice: int)
31        mutex.Lock()
32        dice_avail = dice_avail + number_of_dice

```



```

33     self.Print("returned", number_of_dice)
34
35     -- ensure signal when enough and the queue order unchanged
36     dice_not_enough.Signal(&mutex)
37     mutex.Unlock()
38
39 endMethod

```

- Return(number\_of\_dice: int)

```
1 method Return(number_of_dice: int)
2     mutex.Lock()
3     dice_avail = dice_avail + number_of_dice
4     self.Print("returned", number_of_dice)
5
6     -- ensure signal when enough and the queue order unchanged
7     dice_not_enough.Signal(&mutex)
8     mutex.Unlock()
9
10 endMethod
```

- 测试函数

```
1 var
2     gaming_monitor: gamingParlorMonitor = new gamingParlorMonitor
3     playerArray: array[8] of Thread = new array of Thread {8 of new
4         Thread}
5
6     function gamingParlorProblem()
7         gaming_monitor.Init()
8
9         playerArray[0].Init("A")
10        playerArray[0].Fork(game, 4)
11        playerArray[1].Init("B")
12        playerArray[1].Fork(game, 4)
13        playerArray[2].Init("C")
14        playerArray[2].Fork(game, 5)
15        playerArray[3].Init("D")
16        playerArray[3].Fork(game, 5)
17        playerArray[4].Init("E")
18        playerArray[4].Fork(game, 2)
19        playerArray[5].Init("F")
20        playerArray[5].Fork(game, 2)
```

```

20     playerArray[6].Init("G")
21     playerArray[6].Fork(game, 1)
22     playerArray[7].Init("H")
23     playerArray[7].Fork(game, 1)
24
25     endFunction
26
27     function game(dice_need: int)
28     var
29         i: int
30         j: int
31         for i = 1 to 5
32             gaming_monitor.Request(dice_need)
33
34             -- play
35             for j = 1 to 50
36                 currentThread.Yield()
37             endFor
38
39             gaming_monitor.Return(dice_need)
40
41             -- to avoid a group play continuously
42             currentThread.Yield()
43         endFor
44
45     endFunction

```

- 要点在game(): 每个group进行5次索取。在每次索取后，使用数次（这里50次）currentThread.Yield()表示**play持续时间**。最后归还后，为了避免一个组连续地归还后直接索取，在归还后增加了一个currentThread.Yield()。

## 2、测试结果

### ① 没有play持续时间

```

harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$ blitz -g os
Beginning execution...
===== KPL PROGRAM STARTING =====
Initializing Thread Scheduler...
A requests 4
-----Number of dice now avail = 8
A proceeded with 4
-----Number of dice now avail = 4
A returned 4
-----Number of dice now avail = 8
B requests 4
-----Number of dice now avail = 8
B proceeded with 4
-----Number of dice now avail = 4
C requests 5
-----Number of dice now avail = 4
D requests 5
-----Number of dice now avail = 4
A requests 4
-----Number of dice now avail = 4
B returned 4
-----Number of dice now avail = 8
E requests 2
-----Number of dice now avail = 8
G requests 1
-----Number of dice now avail = 8
H requests 1
-----Number of dice now avail = 8
F requests 2
-----Number of dice now avail = 8
C proceeded with 5
-----Number of dice now avail = 3
B requests 4
-----Number of dice now avail = 3
C returned 5
-----Number of dice now avail = 8
D proceeded with 5
-----Number of dice now avail = 3
C requests 5
-----Number of dice now avail = 3

```

```
D returned 5
-----Number of dice now avail = 8
A proceeded with 4
-----Number of dice now avail = 4
D requests 5
-----Number of dice now avail = 4
E proceeded with 2
-----Number of dice now avail = 2
A returned 4
-----Number of dice now avail = 6
G proceeded with 1
-----Number of dice now avail = 5
E returned 2
-----Number of dice now avail = 7
A requests 4
-----Number of dice now avail = 7
G returned 1
-----Number of dice now avail = 8
H proceeded with 1
-----Number of dice now avail = 7
E requests 2
-----Number of dice now avail = 7
H returned 1
-----Number of dice now avail = 8
F proceeded with 2
-----Number of dice now avail = 6
G requests 1
-----Number of dice now avail = 6
H requests 1
-----Number of dice now avail = 6
B proceeded with 4
-----Number of dice now avail = 2
F returned 2
-----Number of dice now avail = 4
B returned 4
-----Number of dice now avail = 8
C proceeded with 5
-----Number of dice now avail = 3
F requests 2
-----Number of dice now avail = 3
B requests 4
-----Number of dice now avail = 3
C returned 5
-----Number of dice now avail = 8
D proceeded with 5
-----Number of dice now avail = 3
```

```
C requests 5
-----Number of dice now avail = 3
D returned 5
-----Number of dice now avail = 8
A proceeded with 4
-----Number of dice now avail = 4
D requests 5
-----Number of dice now avail = 4
E proceeded with 2
-----Number of dice now avail = 2
A returned 4
-----Number of dice now avail = 6
E returned 2
-----Number of dice now avail = 8
G proceeded with 1
-----Number of dice now avail = 7
A requests 4
-----Number of dice now avail = 7
E requests 2
-----Number of dice now avail = 7
G returned 1
-----Number of dice now avail = 8
H proceeded with 1
-----Number of dice now avail = 7
G requests 1
-----Number of dice now avail = 7
H returned 1
-----Number of dice now avail = 8
F proceeded with 2
-----Number of dice now avail = 6
H requests 1
-----Number of dice now avail = 6
B proceeded with 4
-----Number of dice now avail = 2
F returned 2
-----Number of dice now avail = 4
B returned 4
-----Number of dice now avail = 8
C proceeded with 5
-----Number of dice now avail = 3
F requests 2
-----Number of dice now avail = 3
B requests 4
-----Number of dice now avail = 3
```

```
C returned 5
-----Number of dice now avail = 8
D proceeded with 5
-----Number of dice now avail = 3
C requests 5
-----Number of dice now avail = 3
D returned 5
-----Number of dice now avail = 8
A proceeded with 4
-----Number of dice now avail = 4
D requests 5
-----Number of dice now avail = 4
E proceeded with 2
-----Number of dice now avail = 2
A returned 4
-----Number of dice now avail = 6
E returned 2
-----Number of dice now avail = 8
G proceeded with 1
-----Number of dice now avail = 7
A requests 4
-----Number of dice now avail = 7
E requests 2
-----Number of dice now avail = 7
G returned 1
-----Number of dice now avail = 8
H proceeded with 1
-----Number of dice now avail = 7
G requests 1
-----Number of dice now avail = 7
H returned 1
-----Number of dice now avail = 8
F proceeded with 2
-----Number of dice now avail = 6
H requests 1
-----Number of dice now avail = 6
B proceeded with 4
-----Number of dice now avail = 2
F returned 2
-----Number of dice now avail = 4
B returned 4
-----Number of dice now avail = 8
C proceeded with 5
-----Number of dice now avail = 3
F requests 2
-----Number of dice now avail = 3
```

```
B requests 4
-----Number of dice now avail = 3
C returned 5
-----Number of dice now avail = 8
D proceeded with 5
-----Number of dice now avail = 3
C requests 5
-----Number of dice now avail = 3
D returned 5
-----Number of dice now avail = 8
A proceeded with 4
-----Number of dice now avail = 4
D requests 5
-----Number of dice now avail = 4
E proceeded with 2
-----Number of dice now avail = 2
A returned 4
-----Number of dice now avail = 6
E returned 2
-----Number of dice now avail = 8
G proceeded with 1
-----Number of dice now avail = 7
E requests 2
-----Number of dice now avail = 7
G returned 1
-----Number of dice now avail = 8
H proceeded with 1
-----Number of dice now avail = 7
H returned 1
-----Number of dice now avail = 8
G requests 1
-----Number of dice now avail = 8
F proceeded with 2
-----Number of dice now avail = 6
H requests 1
-----Number of dice now avail = 6
F returned 2
-----Number of dice now avail = 8
B proceeded with 4
-----Number of dice now avail = 4
F requests 2
-----Number of dice now avail = 4
B returned 4
-----Number of dice now avail = 8
C proceeded with 5
-----Number of dice now avail = 3
```

```

C returned 5
-----Number of dice now avail = 8
D proceeded with 5
-----Number of dice now avail = 3
D returned 5
-----Number of dice now avail = 8
E proceeded with 2
-----Number of dice now avail = 6
G proceeded with 1
-----Number of dice now avail = 5
E returned 2
-----Number of dice now avail = 7
G returned 1
-----Number of dice now avail = 8
H proceeded with 1
-----Number of dice now avail = 7
H returned 1
-----Number of dice now avail = 8
F proceeded with 2
-----Number of dice now avail = 6
F returned 2
-----Number of dice now avail = 8

**** A 'wait' instruction was executed and no more interrupts are scheduled... halting emulation! ****

Done! The next instruction to execute will be:
000EC8: 09000000      ret
Number of Disk Reads   = 0
Number of Disk Writes  = 0
Instructions Executed   = 505420
Time Spent Sleeping    = 0
    Total Elapsed Time = 505420
harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$

```

### ① 有play持续时间

为了您看得方便，还是直接复制结果吧...

```

1  harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$ blitz -g
   os
2  Beginning execution...
3  ===== KPL PROGRAM STARTING =====
4  Initializing Thread Scheduler...
5  A requests 4
6  -----Number of dice now avail = 8
7  A proceeded with 4
8  -----Number of dice now avail = 4
9  B requests 4
10 -----Number of dice now avail = 4
11 B proceeded with 4
12 -----Number of dice now avail = 0
13 C requests 5
14 -----Number of dice now avail = 0
15 D requests 5
16 -----Number of dice now avail = 0
17 E requests 2
18 -----Number of dice now avail = 0
19 F requests 2

```



```

20 -----Number of dice now avail = 0
21 G requests 1
22 -----Number of dice now avail = 0
23 H requests 1
24 -----Number of dice now avail = 0
25 B returned 4
26 -----Number of dice now avail = 4
27 B requests 4
28 -----Number of dice now avail = 4
29 A returned 4
30 -----Number of dice now avail = 8
31 C proceeded with 5
32 -----Number of dice now avail = 3
33 A requests 4
34 -----Number of dice now avail = 3
35 C returned 5
36 -----Number of dice now avail = 8
37 D proceeded with 5
38 -----Number of dice now avail = 3
39 E proceeded with 2
40 -----Number of dice now avail = 1
41 C requests 5
42 -----Number of dice now avail = 1
43 D returned 5
44 -----Number of dice now avail = 6
45 F proceeded with 2
46 -----Number of dice now avail = 4
47 D requests 5
48 -----Number of dice now avail = 4
49 G proceeded with 1
50 -----Number of dice now avail = 3
51 H proceeded with 1
52 -----Number of dice now avail = 2
53 E returned 2
54 -----Number of dice now avail = 4
55 B proceeded with 4
56 -----Number of dice now avail = 0
57 E requests 2
58 -----Number of dice now avail = 0
59 G returned 1
60 -----Number of dice now avail = 1
61 G requests 1
62 -----Number of dice now avail = 1
63 F returned 2
64 -----Number of dice now avail = 3
65 H returned 1
66 -----Number of dice now avail = 4
67 A proceeded with 4
68 -----Number of dice now avail = 0
69 H requests 1
70 -----Number of dice now avail = 0
71 F requests 2
72 -----Number of dice now avail = 0
73 B returned 4
74 -----Number of dice now avail = 4
75 B requests 4
76 -----Number of dice now avail = 4
77 A returned 4

```

```

78 -----Number of dice now avail = 8
79 C proceeded with 5
80 -----Number of dice now avail = 3
81 A requests 4
82 -----Number of dice now avail = 3
83 C returned 5
84 -----Number of dice now avail = 8
85 D proceeded with 5
86 -----Number of dice now avail = 3
87 E proceeded with 2
88 -----Number of dice now avail = 1
89 C requests 5
90 -----Number of dice now avail = 1
91 G proceeded with 1
92 -----Number of dice now avail = 0
93 D returned 5
94 -----Number of dice now avail = 5
95 H proceeded with 1
96 -----Number of dice now avail = 4
97 D requests 5
98 -----Number of dice now avail = 4
99 F proceeded with 2
100 -----Number of dice now avail = 2
101 G returned 1
102 -----Number of dice now avail = 3
103 G requests 1
104 -----Number of dice now avail = 3
105 E returned 2
106 -----Number of dice now avail = 5
107 B proceeded with 4
108 -----Number of dice now avail = 1
109 E requests 2
110 -----Number of dice now avail = 1
111 F returned 2
112 -----Number of dice now avail = 3
113 H returned 1
114 -----Number of dice now avail = 4
115 F requests 2
116 -----Number of dice now avail = 4
117 A proceeded with 4
118 -----Number of dice now avail = 0
119 H requests 1
120 -----Number of dice now avail = 0
121 B returned 4
122 -----Number of dice now avail = 4
123 B requests 4
124 -----Number of dice now avail = 4
125 A returned 4
126 -----Number of dice now avail = 8
127 C proceeded with 5
128 -----Number of dice now avail = 3
129 A requests 4
130 -----Number of dice now avail = 3
131 C returned 5
132 -----Number of dice now avail = 8
133 D proceeded with 5
134 -----Number of dice now avail = 3
135 G proceeded with 1

```

```

136 -----Number of dice now avail = 2
137 C requests 5
138 -----Number of dice now avail = 2
139 E proceeded with 2
140 -----Number of dice now avail = 0
141 D returned 5
142 -----Number of dice now avail = 5
143 E returned 2
144 -----Number of dice now avail = 7
145 F proceeded with 2
146 -----Number of dice now avail = 5
147 D requests 5
148 -----Number of dice now avail = 5
149 E requests 2
150 -----Number of dice now avail = 5
151 H proceeded with 1
152 -----Number of dice now avail = 4
153 B proceeded with 4
154 -----Number of dice now avail = 0
155 G returned 1
156 -----Number of dice now avail = 1
157 G requests 1
158 -----Number of dice now avail = 1
159 F returned 2
160 -----Number of dice now avail = 3
161 F requests 2
162 -----Number of dice now avail = 3
163 H returned 1
164 -----Number of dice now avail = 4
165 A proceeded with 4
166 -----Number of dice now avail = 0
167 H requests 1
168 -----Number of dice now avail = 0
169 B returned 4
170 -----Number of dice now avail = 4
171 B requests 4
172 -----Number of dice now avail = 4
173 A returned 4
174 -----Number of dice now avail = 8
175 C proceeded with 5
176 -----Number of dice now avail = 3
177 A requests 4
178 -----Number of dice now avail = 3
179 C returned 5
180 -----Number of dice now avail = 8
181 D proceeded with 5
182 -----Number of dice now avail = 3
183 C requests 5
184 -----Number of dice now avail = 3
185 E proceeded with 2
186 -----Number of dice now avail = 1
187 G proceeded with 1
188 -----Number of dice now avail = 0
189 E returned 2
190 -----Number of dice now avail = 2
191 F proceeded with 2
192 -----Number of dice now avail = 0
193 E requests 2

```

```

194 -----Number of dice now avail = 0
195 D returned 5
196 -----Number of dice now avail = 5
197 H proceeded with 1
198 -----Number of dice now avail = 4
199 B proceeded with 4
200 -----Number of dice now avail = 0
201 D requests 5
202 -----Number of dice now avail = 0
203 G returned 1
204 -----Number of dice now avail = 1
205 G requests 1
206 -----Number of dice now avail = 1
207 F returned 2
208 -----Number of dice now avail = 3
209 F requests 2
210 -----Number of dice now avail = 3
211 H returned 1
212 -----Number of dice now avail = 4
213 A proceeded with 4
214 -----Number of dice now avail = 0
215 H requests 1
216 -----Number of dice now avail = 0
217 B returned 4
218 -----Number of dice now avail = 4
219 A returned 4
220 -----Number of dice now avail = 8
221 C proceeded with 5
222 -----Number of dice now avail = 3
223 E proceeded with 2
224 -----Number of dice now avail = 1
225 C returned 5
226 -----Number of dice now avail = 6
227 D proceeded with 5
228 -----Number of dice now avail = 1
229 G proceeded with 1
230 -----Number of dice now avail = 0
231 E returned 2
232 -----Number of dice now avail = 2
233 F proceeded with 2
234 -----Number of dice now avail = 0
235 D returned 5
236 -----Number of dice now avail = 5
237 H proceeded with 1
238 -----Number of dice now avail = 4
239 G returned 1
240 -----Number of dice now avail = 5
241 F returned 2
242 -----Number of dice now avail = 7
243 H returned 1
244 -----Number of dice now avail = 8
245
246 ***** A 'wait' instruction was executed and no more interrupts are
      scheduled... halting emulation! *****
247
248 Done! The next instruction to execute will be:
249 000EC8: 09000000      ret
250 Number of Disk Reads    = 0

```

```
251 | Number of Disk Writes    = 0
252 | Instructions Executed    = 3144216
253 | Time Spent Sleeping      = 0
254 |     Total Elapsed Time  = 3144216
255 | harryovo@harryovo-virtual-machine:~/Desktop/lab3/osai22/labs/lab3$
```