1.Objective:

To implement Laundry-room simulations of 20 people doing their laundry. A sequence number 1 to 20 will be assigned (generated) to each person when he/she comes. The laundry room allows one person at a time, so the next person must wait in the queue until the current one is done with all his/her laundry. After finishing, a person leaves, and the simulation continues until everyone leaves.

There are two simulations:

1. People come and line up outside a laundry room based on their priorities (0 to 9), which are randomly generated. Then they start entering the laundry room, one by one according to their positions in the queue, to do their laundries.

2. People come and line up outside the laundry room one by one based on their sequence numbers (the sequence of their arrival). Then they start entering the room one by one according to their priorities (randomly generated 0 to 9).

Each person has a certain amount of clothes to wash, which should take a certain amount of time. The time should be randomly generated.

2.What has been developed:

- Understood the problem statement.
- Checked the code in list.h and list.cc files.
- Created the new files for person class. Header file person.h contains the declaration and person.cc contains the definition.
- All the variables declared as private members and getter, setter, constructor as public members. Added definition in person.cc

```
1   /*person.h
2   Contains all the information of a person for Laundr
3   */
4
5   #include "debug.h"
6   class person
7   {
8
9   private:
10      int seq;
11      int priority;
12      int clothes;
13      int laundryTime;
14  public:
15      ~person();
16      person(int s, int p, int c, int l);
17
18      void setSeq(int s);
19      void setPriority(int p);
20      void setClothes(int c);
21      void setLaundryTime(int l);
22
23      static int compare(person* p1, person* p2);
24      int getSeq();
25      int getPriority();
26      int getClothes();
27      int getLaundryTime();
28      int getOrder();
29  };
```

```
29    //setter for sequence number
30    void person::setSeq(int s){
31        seq = s;
32    }
33
34    //setter for Priority
35    void person::setPriority(int p){
36        priority = p;
37    }
38
39    //setter for clothes
40    void person::setClothes(int c){
41        clothes = c;
42    }
43
44    //setter for laundry time
45    void person::setLaundryTime(int l){
46        laundryTime = l;
47    }
48
49    //getter for sequence number
50    int person::getSeq(){
51        return seq;
52    }
53
54    //getter for priority
55    int person::getPriority(){
56        return priority;
57    }
58
59    //getter for clothes
60    int person::getClothes(){
61        return clothes;
62    }
63
64    //getter for laundry time
65    int person::getLaundryTime(){
66        return laundryTime;
67    }
68
```

```
1    /*person.cc
2    Contains definition of all the functions in list.h
3    */
4    #include "person.h"
5
6    //Costructor for person class
7    person::person(int s, int p, int c, int l){
8        seq = s;
9        priority = p;
10       clothes = c;
11       laundryTime = l;
12   }
13
```

- Added person.h, person.cc and person.o filenames in Makefile.

```
266    THREAD_H = ../threads/alarm.h\
267        ../threads/kernel.h\
268        ../threads/main.h\
269        ../threads/scheduler.h\
270        ../threads/switch.h\
271        ../threads/synch.h\
272        ../threads/synchlist.h\
273        ../threads/thread.h\
274        ../threads/person.h
275
276    THREAD_C = ../threads/alarm.cc\
277        ../threads/kernel.cc\
278        ../threads/main.cc\
279        ../threads/scheduler.cc\
280        ../threads/synch.cc\
281        ../threads/synchlist.cc\
282        ../threads/thread.cc\
283        ../threads/threadtest.cc\
284        ../threads/person.cc
285
286    THREAD_O = alarm.o kernel.o main.o scheduler.o synch.o thread.o threadtest.o person.o
287
```

- Created LaundryQueue function in threadtest.cc and called it from ThreadTest function.

```
104    void ThreadTest()
105    {
106        Thread *t = new Thread("forked thread");
107        t->Fork((VoidFunctionPtr) SimpleThread, (void *) 1);
108        LaundryQueue();
109    }
```

- Created object for person and created PrintWaiting function to print person info. Created the priority and laundry time using rand function.

```
12   //Print the information of person standing in line.
13   void PrintWaiting(person* p){
14       printf("Person with Sequence %d, Priority %d, Number of Clothes %d and Laundry Time %d \n", p->getSeq(), p->getPriority(), p->getCl
15   }
16
```

- Implemented the for loop to create the 20 objects of person class. Created sorted list for simulation 1. Inserted 20 objects in sorted list. (in LaundryQueue function)

```
46    //Laundry-room simulations of 20 people
47    void LaundryQueue(){
48
49        List<person*> *list = new List<person*>;
50        SortedList<person*> *sList =  new SortedList<person*>(person::compare);
51
52        int priority;
53        int time;
54
55      //Simulation 1
56        for( int i= 1; i <=20 ; i++){
57            priority = rand() % 10;
58            time = rand() % 10 + 1;
59            person *p = new person(i,priority,time + 1, time);
60            sList->Insert(p);
61        }
62
63        printf("\nSimulation 1 (line up sorted with priority): \n");
64        sList->Apply(PrintWaiting);
65
66        printf("\nSimulation 1 Begins: \n");
67        sList->Apply(PrintLaundry);
68
```

- Added compare function in person class which is used in insert function of SortedList class. Compare function compares the priority and insert the new person object in sorted list.

```
14    //This function is used while inserting the person in sorted list
15    //This function comapres Priorities of person.
16    int person::compare(person* p1, person* p2){
17
18        int p1Priority = p1->getPriority();
19        int p2Priority = p2->getPriority();
20
21        if(p1Priority < p2Priority)
22            return -1;
23        if(p1Priority == p2Priority)
24            return 0;
25        else
26            return 1;
27    }
```

- Printed the sorted list using the Apply and PrintWaiting function. This list contains the output for **Simulation 1: line up outside the laundry room.** (in LaundryQueue function)

```
63        printf("\nSimulation 1 (line up sorted with priority): \n");
64        sList->Apply(PrintWaiting);
65
```

- Created the PrintLaundry function to print the output to after people start entering the room. Used this function and Apply function to print the output. Used following variables to keep track of order number, previous person and total laundry time.

```
6
7    //Variables for storing order, prev person and total Laundry Time
8    int ord = 1;
9    person *prev;
10   int total = 0;
11
```

```
17  //Print the infromation after people start entering the room.
18  void PrintLaundry(person* p){
19      printf("Order %d,", ord);
20      printf("Person with Sequence %d, Priority %d, Number of Clothes %d and Laundry Time %d enters. ", p->getSeq(), p->getPriority(), p-
21      if(ord >1){
22          printf("Person with Sequence %d and Laundry Time %d leaves the room.", prev->getSeq(), prev->getLaundryTime());
23      }
24      printf("\n");
25      prev = p;
26      total = total + p->getLaundryTime();
27      if(ord == 20){
28          printf("Person with Sequence %d and Laundry Time %d leaves the room.", p->getSeq(), p->getLaundryTime());
29          printf("\n\nTotal Laundry Time %d\n",total );
30      }
31      ord++;
32  }
33
```

```
65
66      printf("\nSimulation 1 Begins: \n");
67      sList->Apply(PrintLaundry);
68
```
(in LaundryQueue function)

- Implemented the for loop to create the 20 objects of person class. Created list for simulation 2. Appended 20 objects in list. (in LaundryQueue function)

```
48
49      List<person*> *list = new List<person*>;
```

```
69      //Simulation 2
70      for( int i= 1; i <=20 ; i++){
71          priority = rand() % 10;
72          time = rand() % 10 + 1;
73          person *p = new person(i,priority,time + 1, time);
74          list->Append(p);
75      }
76
```

- Printed the sorted list using the Apply and PrintWaiting function. This list contains the output for **Simulation 2: line up according to Sequence.** (in LaundryQueue function)

```
77      printf("\nSimulation 2 (line up according to Sequence): \n");
78      list->Apply(PrintWaiting);
79
```

- Iterated the full list to find the person with highest priority. Removed that person from the list and added to another list temp. Did the same thing 20 times using for loop. (in LaundryQueue function)

-

```
84
85        for(int i=1; i < 21 ;i++){
86            ListIterator<person*> *iter1 = new ListIterator<person*>(list);
87            person *p2;
88            min = 10;
89            for (; !iter1->IsDone(); iter1->Next()) {
90                person *tempP = iter1->Item();
91                if(min > tempP->getPriority()){
92                    min = tempP->getPriority();
93                    p2 = tempP;
94                }
95            }
96            list->Remove(p2);
97            temp->Append(p2);
98        }
99        ord =1;
100        total =0;
101        temp->Apply(PrintLaundry);
102    }
103
```

- Printed the list using the Apply and PrintWaiting function. This list contains the output for **Simulation 2: After people start entering the room.** (in LaundryQueue function)

```
00            total =0;
01            temp->Apply(PrintLaundry);
02        }
```

3.How to test your solution:

Run following commands to run the code:

cd nachos/code/build.linux
make
./nachos -K

Output will be displayed on the terminal for simulation 1 and 2.

0 is the highest priority.

4.Files modified / Added:

Modified files:
nachos/code/build.linux/Makefile
nachos/code/threads/threadtest.cc

Added files:
nachos/code/threads/person.cc
nachos/code/threads/person.h

5.Output:

Simulation 1: line up outside the laundry room

```
gdamberk@lcs-vc-cis486:~/nachos/code/build.linux$ make
make: 'nachos' is up to date.
gdamberk@lcs-vc-cis486:~/nachos/code/build.linux$ ./nachos -K

Simulation 1 (line up sorted with priority):
Person with Sequence 7, Priority 0, Number of Clothes 11 and Laundry Time 10
Person with Sequence 9, Priority 0, Number of Clothes 8 and Laundry Time 7
Person with Sequence 11, Priority 1, Number of Clothes 10 and Laundry Time 9
Person with Sequence 20, Priority 1, Number of Clothes 4 and Laundry Time 3
Person with Sequence 6, Priority 2, Number of Clothes 9 and Laundry Time 8
Person with Sequence 10, Priority 2, Number of Clothes 8 and Laundry Time 7
Person with Sequence 13, Priority 2, Number of Clothes 2 and Laundry Time 1
Person with Sequence 14, Priority 2, Number of Clothes 5 and Laundry Time 4
Person with Sequence 17, Priority 2, Number of Clothes 10 and Laundry Time 9
Person with Sequence 1, Priority 3, Number of Clothes 8 and Laundry Time 7
Person with Sequence 3, Priority 3, Number of Clothes 7 and Laundry Time 6
Person with Sequence 8, Priority 3, Number of Clothes 8 and Laundry Time 7
Person with Sequence 19, Priority 3, Number of Clothes 8 and Laundry Time 7
Person with Sequence 4, Priority 6, Number of Clothes 4 and Laundry Time 3
Person with Sequence 2, Priority 7, Number of Clothes 7 and Laundry Time 6
Person with Sequence 12, Priority 7, Number of Clothes 11 and Laundry Time 10
Person with Sequence 15, Priority 7, Number of Clothes 7 and Laundry Time 6
Person with Sequence 5, Priority 9, Number of Clothes 3 and Laundry Time 2
Person with Sequence 16, Priority 9, Number of Clothes 4 and Laundry Time 3
Person with Sequence 18, Priority 9, Number of Clothes 9 and Laundry Time 8
```

Simulation 1: After people start entering the room

```
Simulation 1 Begins:
Order 1,Person with Sequence 7, Priority 0, Number of Clothes 11 and Laundry Time 10 enters.
Order 2,Person with Sequence 9, Priority 0, Number of Clothes 8 and Laundry Time 7 enters. Person with Sequence 7 and Laundry Time 10 leaves the room.
Order 3,Person with Sequence 11, Priority 1, Number of Clothes 10 and Laundry Time 9 enters. Person with Sequence 9 and Laundry Time 7 leaves the room.
Order 4,Person with Sequence 20, Priority 1, Number of Clothes 4 and Laundry Time 3 enters. Person with Sequence 11 and Laundry Time 9 leaves the room.
Order 5,Person with Sequence 6, Priority 2, Number of Clothes 9 and Laundry Time 8 enters. Person with Sequence 20 and Laundry Time 3 leaves the room.
Order 6,Person with Sequence 10, Priority 2, Number of Clothes 8 and Laundry Time 7 enters. Person with Sequence 6 and Laundry Time 8 leaves the room.
Order 7,Person with Sequence 13, Priority 2, Number of Clothes 2 and Laundry Time 1 enters. Person with Sequence 10 and Laundry Time 7 leaves the room.
Order 8,Person with Sequence 14, Priority 2, Number of Clothes 5 and Laundry Time 4 enters. Person with Sequence 13 and Laundry Time 1 leaves the room.
Order 9,Person with Sequence 17, Priority 2, Number of Clothes 10 and Laundry Time 9 enters. Person with Sequence 14 and Laundry Time 4 leaves the room.
Order 10,Person with Sequence 1, Priority 3, Number of Clothes 8 and Laundry Time 7 enters. Person with Sequence 17 and Laundry Time 9 leaves the room.
Order 11,Person with Sequence 3, Priority 3, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 1 and Laundry Time 7 leaves the room.
Order 12,Person with Sequence 8, Priority 3, Number of Clothes 8 and Laundry Time 7 enters. Person with Sequence 3 and Laundry Time 6 leaves the room.
Order 13,Person with Sequence 19, Priority 3, Number of Clothes 8 and Laundry Time 7 enters. Person with Sequence 8 and Laundry Time 7 leaves the room.
Order 14,Person with Sequence 4, Priority 6, Number of Clothes 4 and Laundry Time 3 enters. Person with Sequence 19 and Laundry Time 7 leaves the room.
Order 15,Person with Sequence 2, Priority 7, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 4 and Laundry Time 3 leaves the room.
Order 16,Person with Sequence 12, Priority 7, Number of Clothes 11 and Laundry Time 10 enters. Person with Sequence 2 and Laundry Time 6 leaves the room.
Order 17,Person with Sequence 15, Priority 7, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 12 and Laundry Time 10 leaves the room.
Order 18,Person with Sequence 5, Priority 9, Number of Clothes 3 and Laundry Time 2 enters. Person with Sequence 15 and Laundry Time 6 leaves the room.
Order 19,Person with Sequence 16, Priority 9, Number of Clothes 4 and Laundry Time 3 enters. Person with Sequence 5 and Laundry Time 2 leaves the room.
Order 20,Person with Sequence 18, Priority 9, Number of Clothes 9 and Laundry Time 8 enters. Person with Sequence 16 and Laundry Time 3 leaves the room.
Person with Sequence 18 and Laundry Time 8 leaves the room.

Total Laundry Time 123
```

Simulation 2: line up according to Sequence

```
Simulation 2 (line up according to Sequence):
Person with Sequence 1, Priority 9, Number of Clothes 5 and Laundry Time 4
Person with Sequence 2, Priority 1, Number of Clothes 11 and Laundry Time 10
Person with Sequence 3, Priority 4, Number of Clothes 9 and Laundry Time 8
Person with Sequence 4, Priority 8, Number of Clothes 6 and Laundry Time 5
Person with Sequence 5, Priority 5, Number of Clothes 2 and Laundry Time 1
Person with Sequence 6, Priority 3, Number of Clothes 8 and Laundry Time 7
Person with Sequence 7, Priority 1, Number of Clothes 2 and Laundry Time 1
Person with Sequence 8, Priority 6, Number of Clothes 5 and Laundry Time 4
Person with Sequence 9, Priority 2, Number of Clothes 2 and Laundry Time 1
Person with Sequence 10, Priority 6, Number of Clothes 3 and Laundry Time 2
Person with Sequence 11, Priority 5, Number of Clothes 7 and Laundry Time 6
Person with Sequence 12, Priority 4, Number of Clothes 9 and Laundry Time 8
Person with Sequence 13, Priority 6, Number of Clothes 7 and Laundry Time 6
Person with Sequence 14, Priority 6, Number of Clothes 11 and Laundry Time 10
Person with Sequence 15, Priority 3, Number of Clothes 9 and Laundry Time 8
Person with Sequence 16, Priority 4, Number of Clothes 7 and Laundry Time 6
Person with Sequence 17, Priority 2, Number of Clothes 7 and Laundry Time 6
Person with Sequence 18, Priority 4, Number of Clothes 9 and Laundry Time 8
Person with Sequence 19, Priority 4, Number of Clothes 6 and Laundry Time 5
Person with Sequence 20, Priority 3, Number of Clothes 2 and Laundry Time 1
```

Simulation 2: After people start entering the room

```
Simulation 2 Begins:
Order 1,Person with Sequence 2, Priority 1, Number of Clothes 11 and Laundry Time 10 enters.
Order 2,Person with Sequence 7, Priority 1, Number of Clothes 2 and Laundry Time 1 enters. Person with Sequence 2 and Laundry Time 10 leaves the room.
Order 3,Person with Sequence 9, Priority 2, Number of Clothes 2 and Laundry Time 1 enters. Person with Sequence 7 and Laundry Time 1 leaves the room.
Order 4,Person with Sequence 17, Priority 2, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 9 and Laundry Time 1 leaves the room.
Order 5,Person with Sequence 6, Priority 3, Number of Clothes 8 and Laundry Time 7 enters. Person with Sequence 17 and Laundry Time 6 leaves the room.
Order 6,Person with Sequence 15, Priority 3, Number of Clothes 9 and Laundry Time 8 enters. Person with Sequence 6 and Laundry Time 7 leaves the room.
Order 7,Person with Sequence 20, Priority 3, Number of Clothes 2 and Laundry Time 1 enters. Person with Sequence 15 and Laundry Time 8 leaves the room.
Order 8,Person with Sequence 3, Priority 4, Number of Clothes 9 and Laundry Time 8 enters. Person with Sequence 20 and Laundry Time 1 leaves the room.
Order 9,Person with Sequence 12, Priority 4, Number of Clothes 9 and Laundry Time 8 enters. Person with Sequence 3 and Laundry Time 8 leaves the room.
Order 10,Person with Sequence 16, Priority 4, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 12 and Laundry Time 8 leaves the room.
Order 11,Person with Sequence 18, Priority 4, Number of Clothes 9 and Laundry Time 8 enters. Person with Sequence 16 and Laundry Time 6 leaves the room.
Order 12,Person with Sequence 19, Priority 4, Number of Clothes 6 and Laundry Time 5 enters. Person with Sequence 18 and Laundry Time 8 leaves the room.
Order 13,Person with Sequence 5, Priority 5, Number of Clothes 2 and Laundry Time 1 enters. Person with Sequence 19 and Laundry Time 5 leaves the room.
Order 14,Person with Sequence 11, Priority 5, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 5 and Laundry Time 1 leaves the room.
Order 15,Person with Sequence 8, Priority 6, Number of Clothes 5 and Laundry Time 4 enters. Person with Sequence 11 and Laundry Time 6 leaves the room.
Order 16,Person with Sequence 10, Priority 6, Number of Clothes 3 and Laundry Time 2 enters. Person with Sequence 8 and Laundry Time 4 leaves the room.
Order 17,Person with Sequence 13, Priority 6, Number of Clothes 7 and Laundry Time 6 enters. Person with Sequence 10 and Laundry Time 2 leaves the room.
Order 18,Person with Sequence 14, Priority 6, Number of Clothes 11 and Laundry Time 10 enters. Person with Sequence 13 and Laundry Time 6 leaves the room.
Order 19,Person with Sequence 4, Priority 8, Number of Clothes 6 and Laundry Time 5 enters. Person with Sequence 14 and Laundry Time 10 leaves the room.
Order 20,Person with Sequence 1, Priority 9, Number of Clothes 5 and Laundry Time 4 enters. Person with Sequence 4 and Laundry Time 5 leaves the room.
Person with Sequence 1 and Laundry Time 4 leaves the room.

Total Laundry Time 107
gdamberk@lcs-vc-cis486:~/nachos/code/build.linux$ ./nachos -K
```

6.Signed disclosure form:

CIS657 Fall 2018

Assignment Disclosure Form

Assignment #: 2

Name: Gauri Amberkar

1. Did you consult with anyone other than instructor or TA/grader on parts of this assignment?

      If Yes, please give the details.

- No

2. Did you consult an outside source such as an Internet forum or a book on parts of this assignment?

      If Yes, please give the details.

- For rand() function: http://www.cplusplus.com/reference/cstdlib/rand/

- For resolving errors:

      https://stackoverflow.com/questions/15756331/function-pointers-generate-invalid-use-of-non-static-member-function-error

      https://stackoverflow.com/questions/8845117/error-expected-type-specifier-before-classname

      https://www.dreamincode.net/forums/topic/409247-g-fatal-error-no-input-files/

      https://stackoverflow.com/questions/21653680/makefile-issues-g-fatal-error-no-input-files#

      https://stackoverflow.com/questions/4130434/c-undefined-reference-to-defined-function

      https://stackoverflow.com/questions/670734/c-pointer-to-class-data-member

I assert that, to the best of my knowledge, the information on this sheet is true.

Signature: Gauri Amberkar   Date : 21/09/2018