

CS22510 - Assignment 1

Runners and Riders - "Out and About"

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1 Event Creation Program Documentation

1.1 Code Listing

The following section provides the full code listing for the event creation program. This application is written using C++. Doxygen documentation is available via the provided CD.

Listing 1: eventcreator.h

```
1  /**
2   * @file eventcreator.h
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to create courses, entrants and events.
6   */
7
8  #ifndef MENU_H
9  #define MENU_H
10
11 #include <vector>
12 #include "ioscanner.h"
13 #include "fileio.h"
14 #include "event.h"
15
16 class EventCreator {
17 public:
18     EventCreator();
19     virtual ~EventCreator();
20
21     void ShowMainMenu();
22 private:
23     FileIO fio;
24     IOScanner scanner;
25     std::vector<Event> events;
26
27     void MakeEvent();
28     void AddEntrants();
29     void CreateCourse();
30     int ChooseEvent();
31     char ChooseCourse(Event event);
32     void ViewEvent();
33 };
34
35 #endif /* MENU_H */
```

Listing 2: eventcreator.cpp

```

1  /**
2   * @file eventcreator.cpp
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to create courses, entrants and events.
6   * Also outputs and handles user navigation between menus.
7   */
8
9  #include <iostream>
10 #include <string>
11 #include <ctime>
12 #include <algorithm>
13
14 #include "ioscanner.h"
15 #include "eventcreator.h"
16 #include "fileio.h"
17 #include "event.h"
18
19 /**
20  * Initialises the event creator program and outputs startup message
21  */
22 EventCreator::EventCreator() {
23     using namespace std;
24
25     cout << "-----" << endl;
26     cout << "EVENT CREATION PROGRAM" << endl;
27     cout << "-----" << endl << endl;
28 }
29
30 /**
31  * Displays the main menu to the user and processes users choice
32  */
33 void EventCreator::ShowMainMenu() {
34     using namespace std;
35     int input = 0;
36
37     do {
38         cout << "MAIN MENU" << endl;
39         cout << "-----" << endl;
40         cout << "Enter an option: " << endl;
41         cout << "1 - Make new event" << endl;
42         cout << "2 - Add entrants to event" << endl;
43         cout << "3 - Create course for event" << endl;
44         cout << "4 - Write an event to file" << endl;
45         cout << "5 - View an event in the system" << endl;
46         cout << "6 - Exit Program" << endl;
47
48         input = scanner.ReadInt();
49         int evt_index;
50         switch(input) {
51             case 1:
52                 MakeEvent();
53                 break;
54             case 2:
55                 AddEntrants();
56                 break;
57             case 3:
58                 CreateCourse();
59                 break;
60             case 4: //save event to file
61                 evt_index = ChooseEvent();
62                 if(evt_index >= 0) {
63                     Event e = events[evt_index];
64                     fio.WriteEvent(e);
65                 }
66                 break;
67             case 5:
68                 ViewEvent();
69                 break;
70         }
71     }

```

```

72     } while (input != 6);
73 }
74
75 /**
76  * Member function to create a new event on the system.
77  */
78 void EventCreator::MakeEvent() {
79     using namespace std;
80     string evt_name;
81     tm date, time;
82
83     cout << "Enter name of event:" << endl;
84     evt_name = scanner.ReadString(80);
85
86     cout << "Enter event date (DD/MM/YY):" << endl;
87     date = scanner.ReadDate();
88
89     cout << "Enter event start time (HH:MM):" << endl;
90     time = scanner.ReadTime();
91
92     cout << "Enter location of nodes file for event:" << endl;
93     string nodesfile = scanner.ReadString(100);
94     vector<int> nodes = fio.ReadNodesList(nodesfile);
95
96     Event e(evt_name, date, time);
97     e.SetNodes(nodes);
98     events.push_back(e);
99 }
100
101 /**
102  * Member function to add a new entrant to an event.
103  */
104 void EventCreator::AddEntrants() {
105     using namespace std;
106     int eventIndex = ChooseEvent();
107     int numEntrants = 0;
108     string name;
109     int id;
110     char course;
111
112     //if user picked an event
113     if(eventIndex >= 0) {
114         Event event = events[eventIndex];
115
116         //check if we have some courses already.
117         if(event.GetCourses().size() > 0) {
118             cout << "Enter number of entrants to add: " << endl;
119
120             do {
121                 numEntrants = scanner.ReadInt();
122                 if(numEntrants <=0) {
123                     cout << "Not a valid number of entrants" << endl;
124                 } else if (numEntrants > 50) {
125                     cout << "Too many entrants to create at once!" << endl;
126                 }
127             } while (numEntrants <= 0);
128
129             for(int i = 0; i < numEntrants; i++) {
130                 cout << "Enter entrant's name: " << endl;
131                 name = scanner.ReadString(50);
132                 course = ChooseCourse(event);
133                 id = event.GetEntrants().size()+1;
134                 event.AddEntrant(name, id, course);
135                 events[eventIndex] = event;
136             }
137         } else {
138             cout << "You must create at least one course first." << endl;
139         }
140     }
141 }
142

```

```

143  /**
144   * Choose an event to work with if there are events on the system.
145   * @return the id of the chosen event
146   */
147  int EventCreator::ChooseEvent() {
148      using namespace std;
149      int index = -1;
150      bool validChoice = false;
151
152      if(events.size() > 0 ) {
153          cout << "Please choose an event:" << endl;
154          for(std::vector<int>::size_type i = 0; i != events.size(); i++) {
155              cout << i << " - " << events[i].GetName() << endl;
156          }
157
158          do {
159              index = scanner.ReadInt();
160              if (index >= 0 && index < events.size()) {
161                  validChoice = true;
162              } else {
163                  cout << "Not a valid event choice." << endl;
164              }
165          } while(!validChoice);
166
167      } else {
168          cout << "You must create at least one event first." << endl;
169      }
170
171      return index;
172  }
173
174  /**
175   * Choose a course based on the selected event
176   * @param event the currently selected event
177   * @return the id of the chosen course
178   */
179  char EventCreator::ChooseCourse(Event event) {
180      using namespace std;
181      bool validChoice = false;
182      int index;
183      char choice;
184      std::vector<Course> courses = event.GetCourses();
185
186      if(courses.size() > 0 ) {
187          cout << "Please choose course for the entrant:" << endl;
188          for(std::vector<int>::size_type i = 0; i != courses.size(); i++) {
189              cout << i << " - " << courses[i].GetId() << endl;
190          }
191
192          do {
193              index = scanner.ReadInt();
194              if (index >= 0 && index < courses.size()) {
195                  validChoice = true;
196              } else {
197                  cout << "Not a valid course choice." << endl;
198              }
199          } while(!validChoice);
200          choice = courses[index].GetId();
201      } else {
202          cout << "You must create at least one course first." << endl;
203      }
204
205      return choice;
206  }
207
208  /**
209   * Create a course based on the selected event
210   */
211  void EventCreator::CreateCourse() {
212      using namespace std;
213      int eventIndex = ChooseEvent();

```

```

214     int node;
215     vector<int> courseNodes;
216     vector<int> allowedNodes;
217     if(eventIndex >= 0) {
218         Event event = events[eventIndex];
219         allowedNodes = event.GetNodes();
220
221         if(event.GetCourses().size() <= 26) {
222             cout << "Enter nodes for course. Enter 0 to finish: " << endl;
223
224             do {
225                 node = scanner.ReadInt();
226                 if(find(allowedNodes.begin(), allowedNodes.end(), node)!=allowedNodes.end()) {
227                     courseNodes.push_back(node);
228                 } else if (node != 0) {
229                     cout << "Not a valid node number!" << endl;
230                 }
231             } while(node != 0);
232
233             //convert numerical index to character index
234             // e.g. ASCII 'A' is 65, 'B' is 66 etc.
235             char id = (int)event.GetCourses().size()+65;
236
237             event.AddCourse(id, courseNodes);
238             events[eventIndex] = event;
239
240         } else {
241             cout << "Events can not have more than 26 courses" << endl;
242         }
243     }
244 }
245
246 /**
247  * View an event on the system. This will list all course and
248  * entrants associated with the chosen event.
249  */
250 void EventCreator::ViewEvent() {
251     using namespace std;
252     int eventIndex = ChooseEvent();
253     if(eventIndex >= 0) {
254         Event event = events[eventIndex];
255
256         cout << "-----" << endl;
257         cout << event.GetName() << endl;
258         cout << event.GetFormattedDate() << endl;
259         cout << event.GetFormattedTime() << endl;
260         cout << "-----" << endl;
261         cout << "COURSES" << endl;
262         cout << "-----" << endl;
263
264         if(event.GetCourses().size() > 0) {
265             for(vector<Course>::iterator it = event.GetCourses().begin();
266                 it != event.GetCourses().end(); ++it) {
267                 cout << it->GetId() << " ";
268                 cout << it->GetNodes().size() << " " << endl;
269
270                 vector<int> nodes(it->GetNodes());
271                 for(vector<int>::iterator jt = nodes.begin();
272                     jt != nodes.end(); ++jt) {
273                     cout << *jt << endl;
274                 }
275
276                 cout << endl;
277             }
278         } else {
279             cout << "This event has no courses yet!" << endl;
280         }
281
282         cout << "-----" << endl;
283         cout << "ENRTANTS" << endl;
284         cout << "-----" << endl;

```

```

285
286     if(event.GetEntrants().size() > 0) {
287         for (vector<Entrant>::iterator it = event.GetEntrants().begin();
288             it != event.GetEntrants().end(); ++it) {
289             cout << it->GetId() << " " << it->GetCourse() << " ";
290             cout << it->GetName() << endl;
291         }
292     } else {
293         cout << "This event has no entrants yet!" << endl;
294     }
295 }
296 }
297
298 EventCreator::~EventCreator() {
299 }
300
301 /**
302  * Main method and application entry point.
303  * Simply shows the main menu.
304  *
305  * @param argc the number of command line arguments
306  * @param argv the char array of command line arguments
307  * @return program exit status (0)
308  */
309 int main(int argc, char** argv) {
310     EventCreator ec;
311     ec.ShowMainMenu();
312     return 0;
313 }

```

Listing 3: event.h

```

1  /**
2   * @file event.h
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to hold data about an event.
6   */
7
8  #ifndef EVENT_H
9  #define EVENT_H
10
11  #include <string>
12  #include <vector>
13
14  #include "entrant.h"
15  #include "course.h"
16
17  class Event {
18  public:
19      Event(std::string name, tm date, tm time);
20      virtual ~Event();
21
22      void AddEntrant(std::string name, int id, char course);
23      void AddCourse(char id, std::vector<int> nodes);
24      void SetCourses(std::vector<Course> courses);
25      std::vector<Course> GetCourses() const;
26      void SetEntrants(std::vector<Entrant> entrants);
27      std::vector<Entrant> GetEntrants() const;
28      void SetName(std::string name);
29      std::string GetName() const;
30      void SetDate(tm date);
31      tm GetDate() const;
32      void SetTime(tm time);
33      tm GetTime() const;
34      void SetNodes(std::vector<int> nodes);
35      std::vector<int> GetNodes() const;
36
37      std::string GetFormattedDate();
38      std::string GetFormattedTime();
39  private:

```

```

40         tm time;
41         tm date;
42         std::string name;
43         std::vector<Entrant> entrants;
44         std::vector<Course> courses;
45         std::vector<int> nodes;
46
47         std::string GetDayPostfix(int day);
48     };
49
50 #endif /* EVENT_H */

```

Listing 4: event.cpp

```

1  /**
2   * @file event.cpp
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to hold data about an event.
6   */
7
8  #include <string>
9  #include <sstream>
10 #include "event.h"
11 #include "entrant.h"
12
13 /**
14  * Create a new event and initialise it with a name, date and time.
15  * @param name the name of the event
16  * @param date the date of the event
17  * @param time the time of the event
18  */
19 Event::Event(std::string name, tm date, tm time) {
20     this->time = time;
21     this->date = date;
22     this->name = name;
23 }
24
25 Event::~Event() {
26 }
27
28 /**
29  * Add an entrant to this event.
30  * @param name the name of the entrant
31  * @param id the id of the entrant
32  * @param course the id of the entrant's course
33  */
34 void Event::AddEntrant(std::string name, int id, char course) {
35     Entrant entrant(id, name, course);
36     entrants.push_back(entrant);
37 }
38
39 /**
40  * Add a course to this event.
41  * @param id the id of the course
42  * @param nodes the vector of nodes for the course
43  */
44 void Event::AddCourse(char id, std::vector<int> nodes) {
45     Course course(id, nodes);
46     courses.push_back(course);
47 }
48
49 /**
50  * Set the list of courses for this event
51  * @param courses the vector of courses for an event
52  */
53 void Event::SetCourses(std::vector<Course> courses) {
54     this->courses = courses;
55 }
56
57 /**

```

```

58  * Get the list of courses for this event
59  * @return the vector of courses for an event
60  */
61  std::vector<Course> Event::GetCourses() const {
62      return courses;
63  }
64
65  /**
66  * Set the list of entrants for this event
67  * @param entrants the vector of entrants for an event
68  */
69  void Event::SetEntrants(std::vector<Entrant> entrants) {
70      this->entrants = entrants;
71  }
72
73  /**
74  * Get the list of entrants for this event
75  * @return the vector of entrants for an event
76  */
77  std::vector<Entrant> Event::GetEntrants() const {
78      return entrants;
79  }
80
81  /**
82  * Set the name of this event
83  * @param name the name of this event
84  */
85  void Event::SetName(std::string name) {
86      this->name = name;
87  }
88
89  /**
90  * Get the name of this event
91  * @return the name of this event
92  */
93  std::string Event::GetName() const {
94      return name;
95  }
96
97  /**
98  * Set the date of this event
99  * @param date the date of this event
100  */
101  void Event::SetDate(tm date) {
102      this->date = date;
103  }
104
105  /**
106  * Get the date of this event
107  * @return the date of this event
108  */
109  tm Event::GetDate() const {
110      return date;
111  }
112
113  /**
114  * Set the time of this event
115  * @param time the time of this event
116  */
117  void Event::SetTime(tm time) {
118      this->time = time;
119  }
120
121  /**
122  * Get the time of this event
123  * @return the time of this event
124  */
125  tm Event::GetTime() const {
126      return time;
127  }
128

```



```

129  /**
130   * Set the list of nodes for this event
131   * @param nodes the vector of nodes for this event
132   */
133  void Event::SetNodes(std::vector<int> nodes) {
134      this->nodes = nodes;
135  }
136
137  /**
138   * Get the list of nodes for this event
139   * @return the vector of nodes for this event
140   */
141  std::vector<int> Event::GetNodes() const {
142      return nodes;
143  }
144
145  /**
146   * Get the date of the event as a string in a long format
147   * e.g. 1st February 2012
148   * @return the date formatted and as a string
149   */
150  std::string Event::GetFormattedDate() {
151      using namespace std;
152      ostringstream outputDate;
153      char monthname[10];
154      char year[5];
155
156      strftime(monthname, 10, "%B", &date);
157      strftime(year, 5, "%Y", &date);
158
159      outputDate << date.tm_mday;
160      outputDate << GetDayPostfix(date.tm_mday) << " ";
161      outputDate << monthname;
162      outputDate << " ";
163      outputDate << year;
164
165      return outputDate.str();
166  }
167
168  /**
169   * Get the time of the event as a string
170   * e.g. 17:45
171   * @return the time as a string
172   */
173  std::string Event::GetFormattedTime() {
174      using namespace std;
175      ostringstream timeString;
176      char outputTime [6];
177
178      strftime(outputTime, 6, "%R", &time);
179      timeString << outputTime;
180
181      return timeString.str();
182  }
183
184
185  /**
186   * Member function to get the postfix of the date's day
187   * will return a string with either 'st', 'nd' or 'rd'.
188   * @param day the day to get the postfix for
189   * @return the postfix for the date's day
190   */
191  std::string Event::GetDayPostfix(int day) {
192      std::string postfix = "th";
193      switch(day) {
194          case 1:
195          case 21:
196          case 31:
197              postfix = "st";
198              break;
199          case 2:

```

```

200         case 22:
201             postfix = "nd";
202             break;
203         case 3:
204         case 23:
205             postfix = "rd";
206             break;
207     }
208
209     return postfix;
210 }

```

Listing 5: entrant.h

```

1  /**
2   * @file entrant.cpp
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to hold data about an entrant in an event.
6   */
7
8  #ifndef ENTRANT_H
9  #define ENTRANT_H
10
11  #include <string>
12
13  class Entrant {
14  public:
15      Entrant(int id, std::string name, char course);
16      virtual ~Entrant();
17
18      void SetCourse(char course);
19      char GetCourse() const;
20      void SetName(std::string name);
21      std::string GetName() const;
22      void SetId(int id);
23      int GetId() const;
24  private:
25      int id;
26      std::string name;
27      char course;
28  };
29
30  #endif /* ENTRANT_H */

```

Listing 6: entrant.cpp

```

1  /**
2   * @file entrant.cpp
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to hold data about an entrant in an event.
6   */
7
8  #include "entrant.h"
9
10 /**
11  * Initialises a new instance of an entrant with an ID,
12  * name and course.
13  *
14  * @param id the ID of the entrant
15  * @param name the name of entrant
16  * @param course the ID of the course the entrant is registered on.
17  */
18  Entrant::Entrant(int id, std::string name, char course) {
19      SetId(id);
20      SetName(name);
21      SetCourse(course);
22  }
23

```

```

24 Entrant::~Entrant() {
25 }
26
27 /**
28  * Set the course the entrant is on.
29  * @param course the course id
30  */
31 void Entrant::SetCourse(char course) {
32     this->course = course;
33 }
34
35 /**
36  * Get the course the entrant is on.
37  * @return the course id
38  */
39 char Entrant::GetCourse() const {
40     return course;
41 }
42
43 /**
44  * Set the name of the entrant.
45  * @param name the name of the entrant
46  */
47 void Entrant::SetName(std::string name) {
48     this->name = name;
49 }
50
51 /**
52  * Get the name of the entrant.
53  * @return the name of the entrant
54  */
55 std::string Entrant::GetName() const {
56     return name;
57 }
58
59 /**
60  * Set the entrant's ID.
61  * @param id the entrant id
62  */
63 void Entrant::SetId(int id) {
64     this->id = id;
65 }
66
67 /**
68  * Get the entrant's ID.
69  * @return the id of the entrant
70  */
71 int Entrant::GetId() const {
72     return id;
73 }

```

Listing 7: course.h

```

1 /**
2  * @file course.cpp
3  * @author Samuel Jackson (slj11@aber.ac.uk)
4  * @date 09 March 2013
5  * @brief class to hold data about a course in an event.
6  */
7
8 #ifndef COURSE_H
9 #define COURSE_H
10
11 #include <vector>
12
13 class Course {
14 public:
15     Course(char id, std::vector<int> nodes);
16     virtual ~Course();
17
18     void SetNodes(std::vector<int> nodes);

```

```

19     std::vector<int> GetNodes() const;
20     void SetId(char id);
21     char GetId() const;
22 private:
23     char id;
24     std::vector<int> nodes;
25 };
26
27 #endif /* COURSE_H */

```

Listing 8: course.cpp

```

1  /**
2   * @file course.cpp
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to hold data about a course in an event.
6   */
7
8  #include "course.h"
9
10 /**
11  * Initialises an instance of a course with an id
12  * and a set of nodes
13  * @param id the id of the course
14  * @param nodes the nodes in the course
15  */
16 Course::Course(char id, std::vector<int> nodes) {
17     SetId(id);
18     SetNodes(nodes);
19 }
20
21 Course::~Course() {
22 }
23
24 /**
25  * Set the list of nodes in this course
26  * @param nodes the vector of nodes.
27  */
28 void Course::SetNodes(std::vector<int> nodes) {
29     this->nodes = nodes;
30 }
31
32 /**
33  * Get the list of nodes in this course
34  * @return the vector of nodes.
35  */
36 std::vector<int> Course::GetNodes() const {
37     return nodes;
38 }
39
40 /**
41  * Set the ID of this course
42  * @param id the ID of the course
43  */
44 void Course::SetId(char id) {
45     this->id = id;
46 }
47
48 /**
49  * Set the list of nodes in this course
50  * @return the ID of the course.
51  */
52 char Course::GetId() const {
53     return id;
54 }

```

Listing 9: fileio.h

```

1  /**

```

```

2  * @file fileio.h
3  * @author Samuel Jackson (slj11@aber.ac.uk)
4  * @date 09 March 2013
5  * @brief class to read in data files and write out the created event.
6  */
7
8  #ifndef FILEIO_H
9  #define FILEIO_H
10
11 #include <vector>
12 #include <string>
13
14 #include "event.h"
15 #include "entrant.h"
16 #include "course.h"
17
18 class FileIO {
19 public:
20     FileIO();
21     virtual ~FileIO();
22
23     void WriteEvent(Event event);
24     std::vector<int> ReadNodesList(std::string filename);
25 private:
26     bool WriteCoursesFile(std::string filename, std::vector<Course> courses);
27     bool WriteEntrantsFile(std::string filename, std::vector<Entrant> entrants);
28     bool WriteEventFile(std::string filename, Event event);
29 };
30
31 #endif /* FILEIO_H */

```

Listing 10: fileio.cpp

```

1  /**
2  * @file fileio.cpp
3  * @author Samuel Jackson (slj11@aber.ac.uk)
4  * @date 09 March 2013
5  * @brief class to read in data files and write out the created event.
6  */
7
8  #include <iostream>
9  #include <fstream>
10 #include <stdlib.h>
11 #include <sys/stat.h>
12
13 #include "fileio.h"
14 #include "entrant.h"
15 #include "course.h"
16 #include "event.h"
17
18 FileIO::FileIO() {
19 }
20
21 /**
22 * Write an event to file. This makes the courses, entrants and
23 * name files.
24 * @param evt the event to be written to file
25 */
26 void FileIO::WriteEvent(Event evt) {
27     mkdir (evt.GetName().c_str(), 0755);
28
29     WriteEventFile(evt.GetName() + "/name.txt", evt);
30     WriteCoursesFile(evt.GetName() + "/courses.txt", evt.GetCourses());
31     WriteEntrantsFile(evt.GetName() + "/entrants.txt", evt.GetEntrants());
32 }
33
34 /**
35 * Member function to write a vector of courses to a file
36 * @param filename the name and path to create the file
37 * @param courses the vector of courses to write to file

```

```

39  * @return whether the write operation was successful
40  */
41  bool FileIO::WriteCoursesFile(std::string filename,
42                               std::vector<Course> courses) {
43      using namespace std;
44      ofstream out(filename.c_str());
45      bool success = false;
46
47      if(out.is_open()) {
48          for(std::vector<Course>::iterator it = courses.begin();
49              it != courses.end(); ++it) {
50              out << it->GetId() << " ";
51              out << it->GetNodes().size() << " ";
52
53              std::vector<int> nodes = it->GetNodes();
54              for(std::vector<int>::iterator jt = nodes.begin();
55                  jt != nodes.end(); ++jt) {
56                  out << *jt << " ";
57              }
58
59              out << endl;
60          }
61      }
62
63      return success;
64  }
65
66  /**
67   * Member function to write a vector of entrants to a file
68   * @param filename the name and path to create the file
69   * @param entrants the vector of entrants to write to file
70   * @return whether the write operation was successful
71   */
72  bool FileIO::WriteEntrantsFile(std::string filename,
73                                  std::vector<Entrant> entrants) {
74      using namespace std;
75      ofstream out(filename.c_str());
76      bool success = false;
77      if(out.is_open()) {
78          for(std::vector<Entrant>::iterator it = entrants.begin();
79              it != entrants.end(); ++it) {
80              out << it->GetId() << " ";
81              out << it->GetCourse() << " ";
82              out << it->GetName() << endl;
83          }
84
85          out.close();
86          success = true;
87      }
88
89      return success;
90  }
91
92  /**
93   * Member function to read in a list of nodes for a given file
94   * @param filename the name and path to the nodes file
95   * @return vector of nodes read in from file.
96   */
97  std::vector<int> FileIO::ReadNodesList(std::string filename) {
98      using namespace std;
99      string input = "";
100     ifstream in(filename.c_str());
101     int number;
102     char buffer[5];
103     int line = 0;
104     vector<int> nodes;
105
106     if(in.is_open()) {
107         while(!in.eof()) {
108             line++;
109             getline(in, input);

```

```

110         int matches = sscanf (input.c_str(), "%d %s", &number, buffer);
111         if(matches != 2) {
112             cout << "Error parsing nodes file on line: " << line << endl;
113             exit(-1);
114         }
115
116         nodes.push_back(number);
117     }
118 }
119
120 in.close();
121
122 return nodes;
123
124 }
125
126 /**
127  * Member function to write an event to a file
128  * @param filename the name and path to create the file
129  * @param event the event to write to file
130  * @return whether the write operation was successful
131  */
132 bool FileIO::WriteEventFile(std::string filename, Event event) {
133     using namespace std;
134     ofstream out(filename.c_str());
135
136     string name = event.GetName();
137     string date = event.GetFormattedDate();
138     string time = event.GetFormattedTime();
139
140     if (out.is_open()) {
141
142         out << name << endl;
143         out << date << endl;
144         out << time << endl;
145
146         out.close();
147         return true;
148     } else {
149         return false;
150     }
151 }
152
153 FileIO::~FileIO() {
154 }
155

```

Listing 11: ioscanner.h

```

1
2 /**
3  * @file ioscanner.h
4  * @author Samuel Jackson (slj11@aber.ac.uk)
5  * @date 09 March 2013
6  * @brief class to read user input in from the command line in a variety of formats.
7  */
8
9 #ifndef IOSCANER_H
10 #define IOSCANER_H
11
12 #include <string>
13
14 class IOScanner {
15 public:
16     IOScanner();
17     virtual ~IOScanner();
18
19     int ReadInt();
20     std::string ReadString(int limit);
21     tm ReadDate();
22     tm ReadTime();

```

```

23 };
24
25 #endif /* CONSOLE_INPUT_H */

```

Listing 12: ioscanner.cpp

```

1  /**
2   * @file ioscanner.cpp
3   * @author Samuel Jackson (slj11@aber.ac.uk)
4   * @date 09 March 2013
5   * @brief class to read user input in from the command line in a variety of formats.
6   */
7
8  #include <iostream>
9  #include <limits>
10 #include <string>
11 #include <iostream>
12 #include <locale>
13
14 #include "ioscanner.h"
15
16 IOScanner::IOScanner() {
17 }
18
19 /**
20 * Member function to read a single integer from standard in.
21 * @return The integer that was read in
22 */
23 int IOScanner::ReadInt() {
24     using namespace std;
25
26     int input;
27     while (!(cin >> input)) {
28         cout << "Input wasn't a number!\n" ;
29         cin.clear();
30         cin.ignore(std::numeric_limits<streamsize>::max(), '\n') ;
31     }
32     cin.ignore(std::numeric_limits<streamsize>::max(), '\n');
33
34     return input;
35 }
36
37 /**
38 * Member function to read a string from standard in.
39 * @param limit the limit of the number of characters to read in.
40 * @return The string that was read in
41 */
42 std::string IOScanner::ReadString(int limit) {
43     using namespace std;
44     string input = "";
45
46     do {
47         getline(cin, input);
48
49         if(input.size() >= limit) {
50             cout << "Input too long!" << endl;
51         }
52     } while(input.size() >= limit);
53
54     return input;
55 }
56
57 /**
58 * Member function to read a date from standard in. Dates must be entered in
59 * the format DD/MM/YY
60 * @return time structure containing the date that was read in
61 */
62 tm IOScanner::ReadDate() {
63     using namespace std;
64     string date;
65     tm when;

```



```

66     bool valid;
67
68     do {
69         valid = true;
70         date = ReadString(10);
71
72         if(!strptime(date.c_str(), "%d/%m/%y", &when)) {
73             cout << "That wasn't a date!\n" << endl;
74             valid = false;
75         }
76     } while (!valid);
77
78     return when;
79 }
80
81 /**
82  * Member function to read a time from standard in. Dates must be entered in
83  * the format HH:mm
84  * @return time structure containing the time that was read in
85  */
86 tm IOScanner::ReadTime() {
87     using namespace std;
88     string time;
89     tm when;
90     bool valid;
91     do {
92         valid = true;
93         time = ReadString(7);
94
95         if(!strptime(time.c_str(), "%R", &when)) {
96             cout << "That wasn't a time!" << endl;
97             valid = false;
98         }
99     } while(!valid);
100
101     return when;
102 }
103
104
105 IOScanner::~IOScanner() {
106 }

```

1.2 Compilation Output

The following section shows the build log generated by Eclipse when compiling the Event Creation program.

Listing 13: Build log of the C++ Event Creation Program

```

12:22:50 **** Build of configuration Debug for project Event Creator ****
make all
Building file: ../course.cpp
Invoking: GCC C++ Compiler
g++ -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"course.d" -MT"course.d" -o "course.o" "../course.cpp"
Finished building: ../course.cpp

Building file: ../entrant.cpp
Invoking: GCC C++ Compiler
g++ -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"entrant.d" -MT"entrant.d" -o "entrant.o" "../entrant.cpp"
Finished building: ../entrant.cpp

Building file: ../event.cpp
Invoking: GCC C++ Compiler
g++ -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"event.d" -MT"event.d" -o "event.o" "../event.cpp"
Finished building: ../event.cpp

Building file: ../eventcreator.cpp

```

```

Invoking: GCC C++ Compiler
g++ -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"eventcreator.d" -MT"eventcreator.d"
-o "eventcreator.o" "../eventcreator.cpp"
../eventcreator.cpp: In member function int EventCreator::ChooseEvent():
../eventcreator.cpp:160:51: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
../eventcreator.cpp: In member function char EventCreator::ChooseCourse(Event):
../eventcreator.cpp:194:52: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
Finished building: ../eventcreator.cpp

Building file: ../fileio.cpp
Invoking: GCC C++ Compiler
g++ -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"fileio.d" -MT"fileio.d" -o "fileio.o" "../fileio.cpp"
Finished building: ../fileio.cpp

Building file: ../ioscanner.cpp
Invoking: GCC C++ Compiler
g++ -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"ioscanner.d" -MT"ioscanner.d" -o "ioscanner.o" "../ioscanner.cpp"
../ioscanner.cpp: In member function std::string IOScanner::ReadString(int):
../ioscanner.cpp:49:25: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
../ioscanner.cpp:52:29: warning: comparison between signed and unsigned integer expressions [-Wsign-compare]
Finished building: ../ioscanner.cpp

Building target: Event Creator
Invoking: GCC C++ Linker
g++ -o "Event Creator" ./course.o ./entrant.o ./event.o ./eventcreator.o ./fileio.o ./ioscanner.o
Finished building target: Event Creator

```

12:22:53 Build Finished (took 2s.319ms)

1.3 Session Output

This section shows the log of the Event Creation programs execution when creating an event with a short course and a couple of competitors.

Listing 14: Output of C++ Event Creation Program

```

-----
EVENT CREATION PROGRAM
-----

MAIN MENU
-----
Enter an option:
1 - Make new event
2 - Add entrants to event
3 - Create course for event
4 - Write an event to file
5 - View an event in the system
6 - Exit Program
1
Enter name of event:
MyNewEvent
Enter event date (DD/MM/YY):
16/3/13
Enter event start time (HH:MM):
12:00
Enter location of nodes file for event:
../event_3/nodes.txt
MAIN MENU
-----
Enter an option:
1 - Make new event
2 - Add entrants to event
3 - Create course for event
4 - Write an event to file

```

```

5 - View an event in the system
6 - Exit Program
3
Please choose an event:
0 - MyNewEvent
0
Enter nodes for course. Enter 0 to finish:
1
3
4
9
12
14
1
0

```

MAIN MENU

```

-----
Enter an option:
1 - Make new event
2 - Add entrants to event
3 - Create course for event
4 - Write an event to file
5 - View an event in the system
6 - Exit Program
2
Please choose an event:
0 - MyNewEvent
0
Enter number of entrants to add:
3
Enter entrant's name:
Greg Jones
Please choose course for the entrant:
0 - A
0
Enter entrant's name:
Bob Jones
Please choose course for the entrant:
0 - A
0
Enter entrant's name:
Jane Doe
Please choose course for the entrant:
0 - A
0

```

MAIN MENU

```

-----
Enter an option:
1 - Make new event
2 - Add entrants to event
3 - Create course for event
4 - Write an event to file
5 - View an event in the system
6 - Exit Program
4
Please choose an event:
0 - MyNewEvent
0

```

MAIN MENU

```

-----
Enter an option:
1 - Make new event
2 - Add entrants to event
3 - Create course for event
4 - Write an event to file
5 - View an event in the system
6 - Exit Program
6

```

1.4 Generated Output Files

Below shows the files generated using the Event Creation program during the previous run.

Listing 15: name.txt file output from listing 14

```
MyNewEvent
16th March 2013
12:00
```

Listing 16: courses.txt file output from listing 14

```
A 7 1 3 4 9 12 14 1
```

Listing 17: entrants.txt file output from listing 14

```
1 A Greg Jones
2 A Bob Jones
3 A Jane Doe
```

2 Checkpoint Manager Program Documentation

This section provides documentation for the Checkpoint Manager application which is written in Java with a Swing GUI. Full Javadoc for this application is available via the CD.

2.1 Code Listing

Below is a full code listing for the source code to my Checkpoint Manager application.

Listing 18: CheckpointManagerGUI.java

```
1 package checkpoint.manager.gui;
2
3 import checkpoint.manager.FileIO;
4 import checkpoint.manager.datamodel.CPType;
5 import checkpoint.manager.datamodel.Checkpoint;
6 import checkpoint.manager.datamodel.CheckpointManager;
7 import checkpoint.manager.datamodel.Entrant;
8 import checkpoint.manager.exceptions.ArgumentParserException;
9 import java.awt.BorderLayout;
10 import java.awt.Dimension;
11 import java.awt.GridLayout;
12 import java.io.FileNotFoundException;
13 import java.io.IOException;
14 import java.text.ParseException;
15 import java.util.Date;
16 import java.util.HashMap;
17 import java.util.Iterator;
18 import java.util.Map.Entry;
19 import javax.swing.DefaultListModel;
20 import javax.swing.DefaultListSelectionModel;
21 import javax.swing.JButton;
22 import javax.swing.JCheckBox;
23 import javax.swing.JFrame;
```

```

24 import javax.swing.JLabel;
25 import javax.swing.JList;
26 import javax.swing.JOptionPane;
27 import javax.swing.JPanel;
28 import javax.swing.JScrollPane;
29 import javax.swing.JSpinner;
30 import javax.swing.SpinnerDateModel;
31
32 /**
33  * The Class CheckpointManagerGUI.
34  */
35 @SuppressWarnings("serial")
36 public class CheckpointManagerGUI extends JFrame {
37
38     /** The checkpoint list model to store checkpoints in the GUI. */
39     private final DefaultListModel cpListModel;
40
41     /** The checkpoint list to display checkpoints in order. */
42     private JList JLCheckpointList;
43
44     /** The entrant list to display entrants in order. */
45     private JList JLEntrantList;
46
47     /** The entrant list model to store the entrant list in the GUI. */
48     private DefaultListModel entrantListModel;
49
50     /** The checkbox for excluding an entrant. */
51     private final JCheckBox chkMCExcluded;
52
53     /** The button to check in and entrant. */
54     private final JButton btnCheckIn;
55
56     /** The arrival time of the entrant. */
57     private final JSpinner JarrivalTime;
58
59     /** The departure time of the entrant. */
60     private final JSpinner JdepartureTime;
61
62     /** The checkpoint manager GUI event listener. */
63     private final CheckpointManagerListener chkptListener;
64
65     /** The checkpoint manager to process the data model. */
66     private CheckpointManager cpManager;
67
68     /** The current entrant label. */
69     private final JLabel currentEntrant;
70
71     /** The current checkpoint label. */
72     private final JLabel currentCheckpoint;
73
74     /**
75      * Instantiates a new checkpoint manager GUI.
76      *
77      * @param args the args from the command line
78      * @throws FileNotFoundException exception thrown when file cannot be found.
79      * @throws IOException Signals that an unexpected I/O exception has occurred.
80      */
81     public CheckpointManagerGUI(HashMap<String, String> args) throws FileNotFoundException, IOException {
82         this.setSize(500, 600);
83
84         currentEntrant = new JLabel("Current Entrant: ");
85         currentCheckpoint = new JLabel("Current Checkpoint: ");
86
87         try {
88             cpManager = new CheckpointManager(args);
89             if(!cpManager.updateTimes()) {
90                 JOptionPane.showMessageDialog(null, "Could not read the times file!", "Error!", JOptionPane.ERROR_MESSAGE);
91                 System.exit(0);
92             } else {
93                 cpManager.updateLog("Read the times file.");
94             }
95         }
96     }

```

```

95     } catch (ParseException ex) {
96         JOptionPane.showMessageDialog(null, ex, "Could not Parse Text times file!", JOptionPane.ERROR_MESSAGE);
97         System.exit(0);
98     }
99
100     chkptListener = new CheckpointManagerListener(this);
101     cpListModel = new DefaultListModel();
102     entrantListModel = new DefaultListModel();
103     btnCheckIn = new JButton("Check In");
104     chkMCExcluded = new JCheckBox("Exclude entrant for medical reasons");
105     JarrivalTime = new JSpinner(new SpinnerDateModel());
106     JdepartureTime = new JSpinner(new SpinnerDateModel());
107
108     initGUI();
109
110     JLCheckpointList.setSelectedIndex(0);
111     JLEntrantList.setSelectedIndex(0);
112
113     setDefaultCloseOperation(EXIT_ON_CLOSE);
114     setLayout(new GridLayout(1, 3));
115     setVisible(true);
116     pack();
117 }
118
119 /**
120  * Initialises the GUI.
121  */
122 private void initGUI() {
123     JPanel temp = new JPanel();
124     JPanel rightPanel = new JPanel();
125     JPanel centrePanel = new JPanel();
126     JPanel leftPanel = new JPanel();
127
128     //create list of checkpoints
129     JLCheckpointList = new JList(cpListModel);
130     JLCheckpointList.setSelectionMode(DefaultListSelectionModel.SINGLE_SELECTION);
131     JLCheckpointList.setLayoutOrientation(JList.VERTICAL);
132
133     //populate list of checkpoints
134     for (Entry<Integer, Checkpoint> entry : cpManager.getCheckpoints().entrySet()) {
135         Checkpoint chk = (Checkpoint) entry.getValue();
136         cpListModel.addElement(chk.getId() + " " + chk.getType().toString());
137     }
138
139     JLCheckpointList.addListSelectionListener(chkptListener);
140     JScrollPane listScroller = new JScrollPane(JLCheckpointList);
141     listScroller.setPreferredSize(new Dimension(250, 300));
142
143     //layout list of checkpoints
144     temp.add(new JLabel("Checkpoints: "));
145     leftPanel.setLayout(new BorderLayout());
146     leftPanel.add(temp, BorderLayout.NORTH);
147     temp = new JPanel();
148     temp.add(listScroller);
149     leftPanel.add(temp, BorderLayout.SOUTH);
150
151     //create list of entrants
152     JLEntrantList = new JList(entrantListModel);
153     JLEntrantList.setSelectionMode(DefaultListSelectionModel.SINGLE_SELECTION);
154     JLEntrantList.setLayoutOrientation(JList.VERTICAL);
155     refreshEntrants();
156
157     JLEntrantList.addListSelectionListener(chkptListener);
158
159     listScroller = new JScrollPane(JLEntrantList);
160     listScroller.setPreferredSize(new Dimension(250, 300));
161
162     //layout list of entrants
163     rightPanel.setLayout(new BorderLayout());
164     temp = new JPanel();
165     temp.add(new JLabel("Entrants: "));

```

```

166     rightPanel.add(temp);
167     rightPanel.add(temp, BorderLayout.NORTH);
168     temp = new JPanel();
169     temp.add(listScroller);
170     rightPanel.add(temp, BorderLayout.SOUTH);
171
172     //create centre panel
173     JarrivalTime.setModel(new SpinnerDateModel());
174     JarrivalTime.setEditor(new JSpinner.DateEditor(JarrivalTime, "HH:mm"));
175     JdepartureTime.setModel(new SpinnerDateModel());
176     JdepartureTime.setEditor(new JSpinner.DateEditor(JdepartureTime, "HH:mm"));
177
178     btnCheckIn.setActionCommand("CheckIn");
179     btnCheckIn.addActionListener(chkptListener);
180
181     //layout elements in centre panel
182     centrePanel.setLayout(new BorderLayout());
183
184     temp = new JPanel();
185
186     JPanel first = new JPanel();
187     first.add(currentEntrant);
188     temp.add(first);
189     first = new JPanel();
190     first.add(currentCheckpoint);
191     temp.add(first);
192
193     JPanel second = new JPanel();
194     second.add(new JLabel("Arrival Time: "));
195     second.add(JarrivalTime);
196     temp.add(second);
197
198     JPanel third = new JPanel();
199     third.add(new JLabel("Dpearture Time: "));
200     third.add(JdepartureTime);
201     temp.add(third);
202
203     JPanel fourth = new JPanel();
204     fourth.add(chkMCExcluded);
205     temp.add(fourth);
206
207     JPanel fifth = new JPanel();
208     fifth.add(btnCheckIn);
209     temp.add(fifth);
210     centrePanel.add(temp, BorderLayout.CENTER);
211     centrePanel.setPreferredSize(new Dimension(300, 100));
212
213     getContentPane().add(leftPanel);
214     getContentPane().add(centrePanel);
215     getContentPane().add(rightPanel);
216 }
217
218 /**
219  * Parses the ID from the start of a list box item.
220  *
221  * @param list the list model
222  * @param index the index of the selected item
223  * @return the ID
224  */
225 private int parseIndex(DefaultListModel list, int index) {
226     return (Integer.parseInt(list.get(index).toString().split("[a-z ]")[0]));
227 }
228
229 /**
230  * Check in an entrant in response to a users click.
231  */
232 public void doCheckIn() {
233     int index = JLEntrantList.getSelectedIndex();
234     int entrantId = parseIndex(entrantListModel, index);
235     index = JLCheckpointList.getSelectedIndex();
236     int checkpointId = parseIndex(cpListModel, index);

```

```

237     Checkpoint checkpoint = cpManager.getCheckpoint(checkpointId);
238
239     Date arrivalTime = (Date) JarrivalTime.getValue();
240     Date departureTime = null;
241     boolean mcExcluded = chkMCExcluded.isSelected();
242     boolean successful = false;
243     boolean validInput = true;
244
245     //reload the times file.
246     try {
247         successful = cpManager.updateTimes();
248         if(!successful) {
249             JOptionPane.showMessageDialog(this, "Could not reload times! Perhaps file was locked by another process?");
250         } else {
251             cpManager.updateLog("Read the times file.");
252         }
253     } catch (FileNotFoundException ex) {
254         JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
255     } catch (IOException ex) {
256         JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
257     } catch (ParseException ex) {
258         JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
259     }
260
261     if(successful) {
262         //check if we're at a medical checkpoint
263         if(JdepartureTime.isEnabled()) {
264             departureTime = (Date) JdepartureTime.getValue();
265         }
266
267         //check if the times entered were valid
268         if((checkpoint.getType()==CPTType.MC && cpManager.compareTime(arrivalTime, departureTime))
269             || !cpManager.checkValidTime(entrantId, arrivalTime)) {
270             JOptionPane.showMessageDialog(this, "Invalid time data!");
271             validInput = false;
272         }
273
274         if(validInput) {
275             //check if the entrant will be excluded with this update
276             if(cpManager.willExcludedEntrant(entrantId, checkpointId) || mcExcluded) {
277                 //confirm this with the user.
278                 int confirm = JOptionPane.showConfirmDialog(this,
279                     "This will exclude the entrant. Are you sure?",
280                     "Confirm Choice", JOptionPane.YES_NO_OPTION);
281                 validInput = (confirm == JOptionPane.YES_OPTION) ? true : false;
282             }
283         }
284     }
285
286     if(validInput) {
287
288         //perform the update
289         try {
290             successful = cpManager.checkInEntrant(entrantId, checkpointId, arrivalTime, departureTime, mcExcluded);
291             refreshEntrants();
292         } catch (FileNotFoundException ex) {
293             JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
294         } catch (IOException ex) {
295             JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
296         } catch (ParseException ex) {
297             JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
298         }
299
300         //feedback to the user if successful
301         if(successful) {
302             JOptionPane.showMessageDialog(this, "Checked in!");
303         } else {
304             JOptionPane.showMessageDialog(this, "Could not check in entrant! Perhaps file was locked by another process?");
305         }
306
307         try {

```



```

308         successful = cpManager.updateLog("Checked in entrant " + entrantId + " @ node " + checkpointId);
309     } catch (FileNotFoundException ex) {
310         JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
311     } catch (IOException ex) {
312         JOptionPane.showMessageDialog(this, ex, "Error:", JOptionPane.ERROR_MESSAGE);
313     }
314
315     if(!successful) {
316         JOptionPane.showMessageDialog(this, "Could not write to log file!");
317     }
318 }
319 }
320
321 /**
322  * Update the GUI "currently selected" labels in response to user interaction.
323  */
324 public void updateOutput() {
325     int index = JLCheckpointList.getSelectedIndex();
326
327     if(index >= 0) {
328         String currentChkpt = cpListModel.get(index).toString();
329         currentCheckpoint.setText("Current Checkpoint: " + currentChkpt);
330     }
331
332     index = JLEntrantList.getSelectedIndex();
333     if(index >= 0) {
334         String entrant = entrantListModel.get(index).toString();
335         currentEntrant.setText("Current Entrant: " + entrant);
336     }
337 }
338
339 /**
340  * Toggle input for a medical checkpoint
341  */
342 public void toggleMedicalCPInput() {
343     int index = JLCheckpointList.getSelectedIndex();
344     int cpId = (Integer.parseInt(cpListModel.get(index).toString().split("[a-z ]")[0]));
345     if(cpManager.getCheckpoint(cpId).getType() == CPTYPE.MC) {
346         JdepartureTime.setEnabled(true);
347         chkMCExcluded.setEnabled(true);
348     } else {
349         JdepartureTime.setEnabled(false);
350         chkMCExcluded.setEnabled(false);
351     }
352 }
353
354 /**
355  * The main method and entry point to the application.
356  *
357  * @param args the command line arguments
358  */
359 public static void main(String[] args) {
360     try {
361         HashMap<String, String> cmdArgs;
362         cmdArgs = FileIO.parseArgs(args);
363         CheckpointManagerGUI gui = new CheckpointManagerGUI(cmdArgs);
364     } catch (ArgumentParseException ex) {
365         printHelp();
366         System.exit(0);
367     } catch (FileNotFoundException ex) {
368         JOptionPane.showMessageDialog(null, ex, "Error:", JOptionPane.ERROR_MESSAGE);
369         System.exit(0);
370     } catch (IOException ex) {
371         JOptionPane.showMessageDialog(null, ex, "Error:", JOptionPane.ERROR_MESSAGE);
372         System.exit(0);
373     }
374 }
375
376 /**
377  * Prints the help menu to the console.
378  */

```

```

379     private static void printHelp() {
380         System.out.println("Checkpoint Manager -- Usage:");
381         System.out.println("Please supply the following files using the given flags");
382         System.out.println(" -E <entrants file>");
383         System.out.println(" -C <courses file>");
384         System.out.println(" -K <checkpoints file>");
385         System.out.println(" -T <times file>");
386         System.out.println(" -L <log file>");
387     }
388
389     /**
390      * Refresh the list of entrants.
391      */
392     private void refreshEntrants() {
393         entrantListModel = new DefaultListModel();
394         Iterator<Entry<Integer,Entrant>> it = cpManager.getEntrants().entrySet().iterator();
395         while (it.hasNext()) {
396             Entrant e = (Entrant) ((Entry<Integer, Entrant>) it.next()).getValue();
397             if(!(e.isExcluded() || e.isFinished())) {
398                 entrantListModel.addElement(e.getId() + " " + e.getName());
399             }
400         }
401
402         JLEntrantList.setModel(entrantListModel);
403         JLEntrantList.setSelectedIndex(0);
404     }
405 }

```

Listing 19: CheckpointManagerListener.java

```

1  /*
2   * To change this template, choose Tools | Templates
3   * and open the template in the editor.
4   */
5  package checkpoint.manager.gui;
6
7  import java.awt.event.ActionEvent;
8  import java.awt.event.ActionListener;
9  import javax.swing.event.ListSelectionEvent;
10 import javax.swing.event.ListSelectionListener;
11
12 // TODO: Auto-generated Javadoc
13 /**
14  * The listener interface for receiving checkpointManager events.
15  * The class that is interested in processing a checkpointManager
16  * event implements this interface, and the object created
17  * with that class is registered with a component using the
18  * component's <code>addCheckpointManagerListener<code> method. When
19  * the checkpointManager event occurs, that object's appropriate
20  * method is invoked.
21  *
22  * @author samuel
23  */
24 public class CheckpointManagerListener implements ActionListener, ListSelectionListener {
25
26     /** The parent. */
27     private final CheckpointManagerGUI parent;
28
29     /**
30      * Instantiates a new checkpoint manager listener.
31      *
32      * @param parent the parent
33      */
34     CheckpointManagerListener(CheckpointManagerGUI parent) {
35         this.parent = parent;
36     }
37
38     /** (non-Javadoc)
39      * @see java.awt.event.ActionListener#actionPerformed(java.awt.event.ActionEvent)
40      */
41     @Override

```

```

42     public void actionPerformed(ActionEvent ae) {
43         if(ae.getActionCommand().equals("CheckIn")) {
44             parent.doCheckIn();
45         }
46     }
47
48     /* (non-Javadoc)
49      * @see javax.swing.event.ListSelectionListener#valueChanged(javax.swing.event.ListSelectionEvent)
50      */
51     @Override
52     public void valueChanged(ListSelectionEvent lse) {
53         parent.updateOutput();
54         parent.toggleMedicalCPInput();
55     }
56 }
57 }

```

Listing 20: CheckpointManager.java

```

1  package checkpoint.manager.datamodel;
2
3  import checkpoint.manager.FileIO;
4  import java.io.FileNotFoundException;
5  import java.io.IOException;
6  import java.text.ParseException;
7  import java.text.SimpleDateFormat;
8  import java.util.Date;
9  import java.util.HashMap;
10 import java.util.LinkedHashMap;
11 import java.util.PriorityQueue;
12
13 /**
14  * The Class CheckpointManager.
15  * Main management class to the underlying data model.
16  * Manages the processing and updating of data from user input via the GUI
17  * into the data files.
18  * @author Samuel Jackson (slj11@aber.ac.uk)
19  */
20 public class CheckpointManager {
21
22     /** The FileIO object to write to files. */
23     private final FileIO fio;
24
25     /** The LinkedHashMap of entrants. Entrant ID used as key. */
26     private LinkedHashMap<Integer, Entrant> entrants;
27
28     /** The LinkedHashMap of checkpoints. Checkpoint ID used as key */
29     private LinkedHashMap<Integer, Checkpoint> checkpoints;
30
31     /** The HashMap of courses. Course ID used as key */
32     private HashMap<Character, Course> courses;
33
34     /** The PriorityQueue of times. Oldest time has highest priority */
35     private PriorityQueue<CPTimeData> times;
36
37     /**
38      * Instantiates a new checkpoint manager.
39      *
40      * @param args the arguments supplied via the command line.
41      * @throws FileNotFoundException exception thrown when file cannot be found.
42      * @throws IOException Signals that an unexpected I/O exception has occurred.
43      * @throws ParseException the parse exception thrown by failing to parse a date.
44      */
45     public CheckpointManager(HashMap<String, String> args)
46         throws FileNotFoundException, IOException, ParseException {
47
48         fio = new FileIO(args);
49         entrants = fio.readEntrants();
50         checkpoints = fio.readCheckpoints();
51         courses = fio.readCourses(checkpoints);
52     }

```

```

53
54 /**
55  * Check if updating an entrant to the given checkpoint ID will cause the
56  * entrant to be excluded.
57  *
58  * @param entrantId the entrant's id
59  * @param chkptId the checkpoint id
60  * @return true, if successful
61  */
62 public boolean willExcludedEntrant(int entrantId, int chkptId) {
63
64     Entrant entrant = getEntrant(entrantId);
65     Course course = courses.get(entrant.getCourse());
66
67     if(!entrant.isFinished()) {
68         if(course.getNode(entrant.getPosition()+1) != chkptId
69             && (!entrant.hasStarted() || entrant.getLatestTime().getUpdateType() != 'A')) {
70             return true;
71         }
72     }
73
74     return false;
75 }
76
77 /**
78  * Re-read the times file and update all entrants with a new set of times.
79  *
80  * @return true, if successful in reading the file
81  * @throws FileNotFoundException exception thrown when file cannot be found.
82  * @throws ParseException the parse exception if a date could not be parsed.
83  * @throws IOException Signals that an unexpected I/O exception has occurred.
84  */
85 public boolean updateTimes()
86     throws FileNotFoundException, ParseException, IOException {
87     times = fio.readCheckpointData(entrants, courses);
88
89     //Failed to acquire lock or not
90     return (times != null);
91 }
92
93 /**
94  * Check compare the time part of two instances of a date object
95  *
96  * @param time the first time to be compared
97  * @param time2 the second time to be compared
98  * @return true, if the time is valid
99  */
100 public boolean compareTime(Date time, Date time2) {
101     SimpleDateFormat sdf = new SimpleDateFormat("HH:mm");
102     return sdf.format(time).compareTo(sdf.format(time2)) >= 0;
103 }
104
105 /**
106  * Check if the supplied time is a valid time.
107  *
108  * @param entrantId the entrant ID
109  * @param time the time to be checked.
110  * @return true, if the time is valid
111  */
112 public boolean checkValidTime(int entrantId, Date time) {
113     Entrant entrant = getEntrant(entrantId);
114     if(entrant.hasStarted()) {
115         if(compareTime(entrant.getLatestTime().getTime(), time)) {
116             return false;
117         }
118     }
119
120     return true;
121 }
122
123 /**

```

```

124 * Check in entrant.
125 *
126 * @param entrantId the entrant ID
127 * @param chkptId the checkpoint ID
128 * @param arrivalTime the arrival time of the entrant
129 * @param departureTime the departure time of the entrant
130 * @param mcExcluded the flag for if the entrant is excluded for medical reasons
131 * @return true, if successful at writing data to file.
132 * @throws FileNotFoundException exception thrown when file cannot be found.
133 * @throws IOException Signals that an unexpected I/O exception has occurred.
134 * @throws ParseException the parse exception if a date could not be parsed.
135 */
136 public boolean checkInEntrant(int entrantId, int chkptId,
137     Date arrivalTime, Date departureTime, boolean mcExcluded)
138     throws FileNotFoundException, IOException, ParseException {
139
140     boolean checkedIn = false;
141     Date checkInTime;
142     Entrant entrant = entrants.get(entrantId);
143     Checkpoint chkpoint = checkpoints.get(chkptId);
144     Course course = courses.get(entrant.getCourse());
145     char updateType = 'T';
146
147     if(!entrant.isExcluded()) {
148         checkInTime = arrivalTime;
149
150         //set arrival time if medical checkpoint
151         if (chkpoint.getType() == CPTType.MC) {
152             checkInTime = departureTime;
153             addEntrantTime(entrantId, chkptId, arrivalTime, 'A', CPTType.MC);
154             updateType = 'D';
155         }
156
157         CPType type = (updateType == 'D') ? CPType.MC : CPType.CP;
158
159         //exclude entrant if they failed for medical reasons
160         if (mcExcluded) {
161             entrant.setExcluded(true);
162             updateType = 'E';
163         }
164
165         //exclude entrant if they came to wrong checkpoint
166         if(willExcludedEntrant(entrant.getId(), chkpoint.getId())) {
167             entrant.setExcluded(true);
168             updateType = 'I';
169         }
170
171         //check if the entrant is after this update
172         if(entrant.getPosition() >= course.getLength()-2) {
173             entrant.setFinished(true);
174         }
175
176         addEntrantTime(entrantId, chkptId, checkInTime, updateType, type);
177         entrant.incrementPosition();
178         checkedIn = fio.writeTimes(times);
179     }
180
181     return checkedIn;
182 }
183
184 /**
185 * Output an update to the log file.
186 * @param output the output to add to the log file.
187 * @return true, if updating the log file was successful
188 * @throws IOException Signals that an unexpected I/O exception has occurred.
189 * @throws FileNotFoundException exception thrown when file cannot be found.
190 */
191 public boolean updateLog(String output) throws FileNotFoundException, IOException {
192     return fio.writeLog(output);
193 }
194

```

```

195  /**
196   * Creates a time update and adds it to the list of times and the entrant's
197   * time list.
198   *
199   * @param entrantId the entrant ID
200   * @param chkptId the checkpoint ID
201   * @param date the time of the update
202   * @param updateType the type of update (T, I, A, D, E)
203   * @param type the type of checkpoint.
204   */
205  private void addEntrantTime(int entrantId, int chkptId, Date date, char updateType, CPType type) {
206      CPTimeData time = new CPTimeData();
207      time.setTime(date);
208      time.setEntrantId(entrantId);
209      time.setType(type);
210      time.setUpdateType(updateType);
211      time.setNode(chkptId);
212      entrants.get(entrantId).addTime(time);
213      times.add(time);
214  }
215
216  /**
217   * Gets an entrant with the given ID.
218   *
219   * @param id the ID of the entrant
220   * @return the entrant with the given ID
221   */
222  public Entrant getEntrant(int id) {
223      return getEntrants().get(id);
224  }
225
226  /**
227   * Gets a checkpoint with the given ID
228   *
229   * @param id the ID of the checkpoint
230   * @return the checkpoint with the given ID
231   */
232  public Checkpoint getCheckpoint(int id) {
233      return getCheckpoints().get(id);
234  }
235
236  /**
237   * Gets the list of entrants.
238   *
239   * @return the entrant list
240   */
241  public HashMap<Integer, Entrant> getEntrants() {
242      return entrants;
243  }
244
245  /**
246   * Gets the list of checkpoints.
247   *
248   * @return the checkpoint list
249   */
250  public LinkedHashMap<Integer, Checkpoint> getCheckpoints() {
251      return checkpoints;
252  }
253  }

```

Listing 21: Entrant.java

```

1
2  package checkpoint.manager.datamodel;
3
4  import java.util.ArrayList;
5
6  /**
7   * The Class Entrant.
8   * Holds data about a single entrant in the event.
9   * @author Samuel Jackson (slj11@aber.ac.uk)

```

```

10  */
11  public class Entrant {
12
13      /** The name of the entrant. */
14      private String name;
15
16      /** The course the entrant is on. */
17      private char course;
18
19      /** The id of the entrant. */
20      private int id;
21
22      /** The list of time updates an entrant has been checked in on. */
23      private ArrayList<CPTimeData> times;
24
25      /** Whether the entrant has been excluded or not. */
26      private boolean excluded;
27
28      /** Whether the entrant has finished or not. */
29      private boolean finished;
30
31      /** The position of the entrant on the course. */
32      private int position;
33
34      /**
35       * Instantiates a new entrant.
36       */
37      public Entrant() {
38          times = new ArrayList<CPTimeData>();
39          excluded = false;
40          finished = false;
41          position = -1;
42      }
43
44      /**
45       * Gets the name of this entrant.
46       *
47       * @return the name
48       */
49      public String getName() {
50          return name;
51      }
52
53      /**
54       * Sets the name of this entrant.
55       *
56       * @param name the name to set
57       */
58      public void setName(String name) {
59          this.name = name;
60      }
61
62      /**
63       * Gets the course the entrant is on.
64       *
65       * @return the course
66       */
67      public char getCourse() {
68          return course;
69      }
70
71      /**
72       * Sets the course the entrant is on.
73       *
74       * @param course the course to set
75       */
76      public void setCourse(char course) {
77          this.course = course;
78      }
79
80      /**

```

```

81     * Gets the id of the entrant.
82     *
83     * @return the id
84     */
85     public int getId() {
86         return id;
87     }
88
89     /**
90     * Sets the id of the entrant.
91     *
92     * @param id the id to set
93     */
94     public void setId(int id) {
95         this.id = id;
96     }
97
98     /**
99     * Gets the times the entrant has been check in at.
100    *
101    * @return the times
102    */
103    public ArrayList<CPTimeData> getTimes() {
104        return times;
105    }
106
107    /**
108    * Sets the times the entrant has been check in at.
109    *
110    * @param times the times to set
111    */
112    public void setTimes(ArrayList<CPTimeData> times) {
113        this.times = times;
114    }
115
116    /**
117    * Adds a time update to the entrant
118    *
119    * @param cpData the cp data
120    */
121    public void addTime(CPTimeData cpData) {
122        this.times.add(cpData);
123    }
124
125    /**
126    * Checks if is excluded.
127    *
128    * @return the excluded
129    */
130    public boolean isExcluded() {
131        return excluded;
132    }
133
134    /**
135    * Sets the as excluded or not.
136    *
137    * @param excluded the excluded to set
138    */
139    public void setExcluded(boolean excluded) {
140        this.excluded = excluded;
141    }
142
143    /**
144    * Gets the position of the entrant.
145    *
146    * @return the position
147    */
148    public int getPosition() {
149        return position;
150    }
151

```



```

152     /**
153      * Reset position of the entrant.
154      */
155     public void resetPosition() {
156         position = -1;
157     }
158
159     /**
160      * Increment position of the entrant.
161      */
162     public void incrementPosition() {
163         position++;
164     }
165
166     /**
167      * Check if the entrant has started.
168      *
169      * @return true, if entrant has started
170      */
171     public boolean hasStarted() {
172         return (times.size() > 0);
173     }
174
175     /**
176      * Gets the latest time currently available for the entrant.
177      *
178      * @return the latest time
179      */
180     public CPTimeData getLatestTime() {
181         return times.get(times.size()-1);
182     }
183
184     /**
185      * Checks if is finished has finished.
186      *
187      * @return the finished
188      */
189     public boolean isFinished() {
190         return finished;
191     }
192
193     /**
194      * Sets the finished as been finished or not.
195      *
196      * @param finished the finished to set
197      */
198     public void setFinished(boolean finished) {
199         this.finished = finished;
200     }
201 }

```

Listing 22: Course.java

```

1 package checkpoint.manager.datamodel;
2
3 import java.util.ArrayList;
4
5 /**
6  * The Class Course.
7  * Holds data about a single course
8  *
9  * @author Samuel Jackson (slj11@aber.ac.uk)
10  */
11 public class Course {
12
13     /** The id of the course */
14     private char id;
15
16     /** The nodes in the course */
17     private ArrayList<Integer> nodes;
18

```

```

19  /**
20   * Gets the id of the course.
21   *
22   * @return the id
23   */
24  public char getId() {
25      return id;
26  }
27
28  /**
29   * Sets the id of the course.
30   *
31   * @param id the id to set
32   */
33  public void setId(char id) {
34      this.id = id;
35  }
36
37  /**
38   * Gets the length.
39   *
40   * @return the length
41   */
42  public int getLength() {
43      return nodes.size();
44  }
45
46  /**
47   * Gets the nodes in the course.
48   *
49   * @return the nodes
50   */
51  public ArrayList<Integer> getNodes() {
52      return nodes;
53  }
54
55  /**
56   * Sets the nodes in the course.
57   *
58   * @param nodes the nodes to set
59   */
60  public void setNodes(ArrayList<Integer> nodes) {
61      this.nodes = nodes;
62  }
63
64  /**
65   * Gets the node.
66   *
67   * @param index the index of the node.
68   * @return the node
69   */
70  public int getNode(int index) {
71      return getNodes().get(index);
72  }
73  }

```

Listing 23: Checkpoint.java

```

1  package checkpoint.manager.datamodel;
2
3  /**
4   * The Class Checkpoint.
5   * Holds data about a single checkpoint (or medical checkpoint) in an event.
6   * @author Samuel Jackson (slj11@aber.ac.uk)
7   */
8  public class Checkpoint {
9
10     /** The id of the checkpoint */
11     private int id;
12
13     /** The type of the checkpoint. */

```

```

14     private CPType type;
15
16     /**
17      * Instantiates a new checkpoint.
18      *
19      * @param id the id of the checkpoint
20      * @param type the type of the checkpoint
21      */
22     public Checkpoint(int id, String type) {
23         this.id = id;
24         this.type = CPType.valueOf(type);
25     }
26
27     /**
28      * Gets the id of the checkpoint.
29      *
30      * @return the id
31      */
32     public int getId() {
33         return id;
34     }
35
36     /**
37      * Gets the type type of the checkpoint.
38      *
39      * @return the type
40      */
41     public CPType getType() {
42         return type;
43     }
44 }

```

Listing 24: CPTimeData.java

```

1  package checkpoint.manager.datamodel;
2
3  import java.text.SimpleDateFormat;
4  import java.util.Calendar;
5  import java.util.Date;
6
7  /**
8   * The Class CPTimeData.
9   * Holds data about a single checkpoint time update.
10  *
11  * @author Samuel Jackson (slj11@aber.ac.uk)
12  */
13  public class CPTimeData implements Comparable<CPTimeData> {
14
15      /** The entrant id of the entrant. */
16      private int entrantId;
17
18      /** The type of checkpoint. */
19      private CPType type;
20
21      /** The update type. One of the 5 types of updates allowed (T, I, A, D, E) . */
22      private char updateType;
23
24      /** The node that the checkpoint update occurred on. */
25      private int node;
26
27      /** The time the update occurred. */
28      private Date time;
29
30      /** The date formatter object. */
31      private final SimpleDateFormat sdf;
32
33      /**
34       * Instantiates a new instance of a checkpoint time data object.
35       */
36      public CPTimeData() {
37         sdf = new SimpleDateFormat("HH:mm");

```

```

38     }
39
40     /**
41     * Gets the entrant's id.
42     *
43     * @return the entrantId
44     */
45     public int getEntrantId() {
46         return entrantId;
47     }
48
49     /**
50     * Sets the entrant id.
51     *
52     * @param entrantId the entrantId to set
53     */
54     public void setEntrantId(int entrantId) {
55         this.entrantId = entrantId;
56     }
57
58     /**
59     * Gets the type.
60     *
61     * @return the type
62     */
63     public CPTYPE getType() {
64         return type;
65     }
66
67     /**
68     * Sets the type of update.
69     *
70     * @param type the type to set
71     */
72     public void setType(CPTYPE type) {
73         this.type = type;
74     }
75
76     /**
77     * Gets the node that the update occurred on.
78     *
79     * @return the cpId
80     */
81     public int getNode() {
82         return node;
83     }
84
85     /**
86     * Sets the node that the update occurred on.
87     *
88     * @param checkpointId the cpId to set
89     */
90     public void setNode(int checkpointId) {
91         this.node = checkpointId;
92     }
93
94     /**
95     * Gets the time as a string.
96     *
97     * @return the time
98     */
99     public String getStringTime() {
100         return sdf.format(time);
101     }
102
103     /**
104     * Gets the time (Date) object.
105     *
106     * @return the time
107     */
108     public Date getTime() {

```

```

109     return time;
110 }
111
112 /**
113  * Sets the time.
114  *
115  * @param time the new time
116  */
117 public void setTime(Date time) {
118
119     this.time = time;
120 }
121
122 /**
123  * Gets the update type. One of the 5 types of updates (T,I,A,D,E)
124  *
125  * @return the updateType
126  */
127 public char getUpdateType() {
128     return updateType;
129 }
130
131 /**
132  * Sets the update type. One of the 5 types of updates (T,I,A,D,E)
133  *
134  * @param updateType the updateType to set
135  */
136 public void setUpdateType(char updateType) {
137     this.updateType = updateType;
138 }
139
140 /* (non-Javadoc)
141  * @see java.lang.Comparable#compareTo(java.lang.Object)
142  */
143 @Override
144 public int compareTo(CPTimeData t) {
145     return sdf.format(time).compareTo(sdf.format(t.getTime()));
146 }
147 }

```

Listing 25: CPTYPE.java

```

1 package checkpoint.manager.datamodel;
2
3 // TODO: Auto-generated Javadoc
4 /**
5  * The Enum CPTYPE.
6  * The used to represent the type of a checkpoint, either regular or medical.
7  * @author Samuel Jackson (slj11@aber.ac.uk)
8  */
9 public enum CPTYPE {
10     CP,
11     MC
12 }

```

Listing 26: FileIO.java

```

1
2 package checkpoint.manager;
3
4 import checkpoint.manager.datamodel.CPTimeData;
5 import checkpoint.manager.datamodel.Checkpoint;
6 import checkpoint.manager.datamodel.Course;
7 import checkpoint.manager.datamodel.Entrant;
8 import checkpoint.manager.exceptions.ArgumentParserException;
9 import java.io.File;
10 import java.io.FileNotFoundException;
11 import java.io.FileOutputStream;
12 import java.io.IOException;
13 import java.io.PrintWriter;

```

```

14 import java.io.RandomAccessFile;
15 import java.nio.channels.FileLock;
16 import java.text.ParseException;
17 import java.text.SimpleDateFormat;
18 import java.util.ArrayList;
19 import java.util.Date;
20 import java.util.HashMap;
21 import java.util.LinkedHashMap;
22 import java.util.Map.Entry;
23 import java.util.PriorityQueue;
24 import java.util.Scanner;
25
26 /**
27  * The Class FileIO.
28  * Reads and writes files used during a race event.
29  *
30  * @author Samuel Jackson (slj11@aber.ac.uk)
31  */
32 public class FileIO {
33
34     /** The simple date formatter */
35     private SimpleDateFormat sdf;
36
37     /** The names of each of the files passed as command line arguments. */
38     private HashMap<String, String> filenames;
39
40     /**
41      * Instantiates a new instance of FileIO.
42      *
43      * @param args HashMap of filenames
44      */
45     public FileIO (HashMap<String, String> args) {
46         filenames = args;
47         sdf = new SimpleDateFormat("HH:mm");
48     }
49
50     /**
51      * Parses the command line arguments.
52      *
53      * @param args the command line arguments
54      * @return HashMap of parse arguments
55      * @throws ArgumentParseException the argument parse exception thrown if
56      * arguments array cannot be parsed.
57      */
58     public static HashMap<String, String> parseArgs(String[] args)
59         throws ArgumentParseException {
60         HashMap<String, String> argsList = new HashMap<String, String>();
61
62         if (args.length == 10) { //all arguments are required
63             for (int i = 0; i < args.length; i+=2) {
64                 String key = "";
65                 switch(args[i].charAt(1)) {
66                     case 'E':
67                         key = "entrants";
68                         break;
69                     case 'T':
70                         key = "times";
71                         break;
72                     case 'C':
73                         key = "courses";
74                         break;
75                     case 'K':
76                         key = "checkpoints";
77                         break;
78                     case 'L':
79                         key = "log";
80                         break;
81                     default:
82                         throw new ArgumentParseException();
83                 }
84

```

```

85         argsList.put(key, args[i+1]);
86     }
87 } else {
88     throw new ArgumentParseException();
89 }
90
91 return argsList;
92 }
93
94 /**
95  * Read in the entrant's file.
96  *
97  * @return the linked HashMap of entrant's, identified by an entrant's ID.
98  * @throws FileNotFoundException exception thrown when file cannot be found.
99  * @throws IOException Signals that an unexpected I/O exception has occurred.
100 */
101 public LinkedHashMap<Integer, Entrant> readEntrants()
102     throws FileNotFoundException, IOException {
103     Scanner in = new Scanner(new File(filenamees.get("entrants")));
104     LinkedHashMap<Integer, Entrant> entrants = new LinkedHashMap<Integer, Entrant>();
105
106     while(in.hasNext()) {
107         Entrant e = new Entrant();
108         e.setId(in.nextInt());
109         e.setCourse(in.next().charAt(0));
110         e.setName(in.nextLine());
111         entrants.put(e.getId(), e);
112     }
113
114     in.close();
115
116     return entrants;
117 }
118
119 /**
120  * Read in the courses file.
121  *
122  * @param checkpoints the HashMap of nodes that are checkpoints (or medical checkpoints).
123  * @return HashMap of courses, identified by the course ID.
124  * @throws FileNotFoundException exception thrown when file cannot be found.
125  * @throws IOException Signals that an unexpected I/O exception has occurred.
126 */
127 public HashMap<Character, Course> readCourses(LinkedHashMap<Integer, Checkpoint> checkpoints)
128     throws FileNotFoundException, IOException {
129     Scanner in = new Scanner(new File(filenamees.get("courses")));
130
131     HashMap<Character, Course> courses = new HashMap<Character, Course>();
132
133     while (in.hasNext()) {
134         ArrayList<Integer> nodes = new ArrayList<Integer>();
135         Course course = new Course();
136         course.setId(in.next().charAt(0));
137
138         while(in.hasNextInt()) {
139             int node = in.nextInt();
140             if(checkpoints.containsKey(node)) {
141                 nodes.add(node);
142             }
143         }
144         course.setNodes(nodes);
145         courses.put(course.getId(), course);
146     }
147
148     in.close();
149
150     return courses;
151 }
152
153 /**
154  * Read checkpoint data.
155  *

```

```

156 * @param entrants the list of entrants to update.
157 * @param courses the list of all courses.
158 * @return PriorityQueue of CPTimeData objects, ordered by oldest time first.
159 * @throws FileNotFoundException exception thrown when file cannot be found.
160 * @throws ParseException the parse exception thrown when a date cannot be parsed.
161 * @throws IOException Signals that an unexpected I/O exception has occurred.
162 */
163 public PriorityQueue<CPTimeData> readCheckpointData(
164     LinkedHashMap<Integer, Entrant> entrants, HashMap<Character, Course> courses)
165     throws FileNotFoundException, ParseException, IOException {
166     RandomAccessFile fis = new RandomAccessFile(filenamees.get("times"), "rw");
167     FileLock fl = fis.getChannel().tryLock();
168     Scanner in = new Scanner(fis.getChannel());
169
170     PriorityQueue<CPTimeData> times = null;
171     Entrant entrant;
172
173     //clear out the entrants times and reset
174     for (Entry<Integer, Entrant> entry : entrants.entrySet()) {
175         entrant = (Entrant) entry.getValue();
176         entrant.setTimes(new ArrayList<CPTimeData>());
177         entrant.resetPosition();
178     }
179
180     //if we have locked the file
181     if(fl != null) {
182         times = new PriorityQueue<CPTimeData>();
183
184         while (in.hasNext()) {
185             CPTimeData chkpoint = new CPTimeData();
186             char type = in.next().charAt(0);
187             int node = in.nextInt();
188             int entrantNo = in.nextInt();
189             Date date = sdf.parse(in.next());
190             entrant = entrants.get(entrantNo);
191
192             //exclude entrant if necessary
193             switch(type) {
194                 case 'I':
195                 case 'E':
196                     entrant.setExcluded(true);
197                     break;
198             }
199
200             //create checkpoint update data
201             chkpoint.setUpdateType(type);
202             chkpoint.setNode(node);
203             chkpoint.setEntrantId(entrantNo);
204             chkpoint.setTime(date);
205
206             Course course = courses.get(entrant.getCourse());
207             if(entrant.getPosition() >= course.getLength()-2) {
208                 entrant.setFinished(true);
209             }
210
211             //update entrant and times list.
212             entrant.incrementPosition();
213             entrant.addTime(chkpoint);
214             times.add(chkpoint);
215         }
216
217         fl.release();
218     }
219
220     in.close();
221     fis.close();
222
223     return times;
224 }
225
226 /**

```



```

227     * Read in the checkpoints file.
228     *
229     * @return the LinkedHashMap of checkpoints (nodes) identified by ID.
230     * @throws FileNotFoundException exception thrown when file cannot be found.
231     * @throws IOException Signals that an unexpected I/O exception has occurred.
232     */
233     public LinkedHashMap<Integer, Checkpoint> readCheckpoints()
234         throws FileNotFoundException, IOException {
235         Scanner in = new Scanner(new File(filenamees.get("checkpoints")));
236
237         LinkedHashMap<Integer, Checkpoint> checkpoints = new LinkedHashMap<Integer, Checkpoint>();
238
239         while(in.hasNext()) {
240             int id = in.nextInt();
241             String type = in.next();
242
243             //ignore junctions
244             if(!type.equals("JN")) {
245                 checkpoints.put(id, new Checkpoint(id, type));
246             }
247         }
248
249         in.close();
250
251         return checkpoints;
252     }
253
254     /**
255     * Write out time data to the times file.
256     *
257     * @param writer the PrintWriter to use to output the time
258     * @param data the data to output to file
259     * @throws FileNotFoundException exception thrown when file cannot be found.
260     * @throws IOException Signals that an unexpected I/O exception has occurred.
261     */
262     private void writeTimeData(PrintWriter writer, CPTimeData data) throws FileNotFoundException, IOException {
263         String time = data.getStringTime();
264         String output = data.getUpdateType() + " " + data.getNode() + " " + data.getEntrantId() + " " + time;
265         writer.write(output + "\n");
266         writer.flush();
267     }
268
269     /**
270     * Write out the list of times to file.
271     *
272     * @param times the list of times to output.
273     * @return true, if successful at writing
274     * @throws FileNotFoundException exception thrown when file cannot be found.
275     * @throws IOException Signals that an unexpected I/O exception has occurred.
276     */
277     public boolean writeTimes(PriorityQueue<CPTimeData> times) throws FileNotFoundException, IOException {
278         FileOutputStream fis = new FileOutputStream(new File(filenamees.get("times")));
279         FileLock fl = fis.getChannel().tryLock();
280         PrintWriter writer = new PrintWriter(fis);
281         boolean writeSuccess = false;
282
283         //we have file lock
284         if(fl != null) {
285             while (!times.isEmpty()) {
286                 //get times in order of priority (oldest first)
287                 CPTimeData t = times.poll();
288                 writeTimeData(writer, t);
289             }
290             fl.release();
291             writeSuccess = true;
292         }
293
294         fis.close();
295         writer.close();
296
297

```

```

298         return writeSuccess;
299     }
300 }
301
302 /**
303  * Write to the log file.
304  *
305  * @param updateText the message to output to the log file
306  * @throws FileNotFoundException exception thrown when file cannot be found.
307  * @throws IOException Signals that an unexpected I/O exception has occurred.
308  * @return true, if successful at writing
309  */
310 public boolean writeLog(String updateText) throws FileNotFoundException, IOException {
311     String outputStr;
312     Date time = new Date();
313     FileOutputStream fis = new FileOutputStream(new File(filenamees.get("log")), true);
314     FileLock fl = fis.getChannel().tryLock();
315     PrintWriter writer = new PrintWriter(fis);
316     boolean writeSuccess = false;
317     //we have file lock
318     if(fl != null) {
319         outputStr = sdf.format(time) + " CMP: " + updateText + "\n";
320         writer.append(outputStr);
321         writer.flush();
322         writeSuccess = true;
323     }
324     fis.close();
325     writer.close();
326
327     return writeSuccess;
328 }
329 }

```

Listing 27: ArgumentParseException.java

```

1
2 package checkpoint.manager.exceptions;
3
4 /**
5  * The Class ArguementParseException.
6  * Thrown if the command line arguments could not be parsed.
7  * @author Samuel Jackson (slj11@aber.ac.uk)
8  */
9 @SuppressWarnings("serial")
10 public class ArgumentParseException extends Exception{
11
12     /* (non-Javadoc)
13      * @see java.lang.Throwable#getMessage()
14      */
15     @Override
16     public String getMessage() {
17         return "Could not parse command line arguments";
18     }
19 }

```

2.2 Compilation Output

Below is the compilation output for the jar file for Checkpoint Manager application.

Listing 28: Build log of the C Event Manager Program

```

ant -f "/home/samuel/Dropbox/Aber/uni_docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager" clean jar
init:
deps-clean:
Updating property file:

```

```

/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build/build-clean.properties
Deleting directory
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build
clean:
init:
deps-jar:
Created dir:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build
Updating property file:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build/build-jar.properties
Created dir:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build/classes
Created dir:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build/empty
Created dir:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build/
generated-sources/ap-source-output
Compiling 10 source files to
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build/classes
warning: [options] bootstrap class path not set in conjunction with -source 1.6
Note:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/src/checkpoint/manager
/gui/CheckpointManagerGUI.java
uses unchecked or unsafe operations.
Note: Recompile with -Xlint:unchecked for details.
1 warning
compile:
Created dir:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/dist
Copying 1 file to /home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/build
Nothing to copy.
Building jar:
/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/dist/Checkpoint_Manager.jar
To run this application from the command line without Ant, try:
java -jar
"/home/samuel/Dropbox/Aber/uni.docs/Paradigms/cs22510-runners-and-riders-redux/Checkpoint Manager/dist/Checkpoint_Manager.jar"
jar:
BUILD SUCCESSFUL (total time: 0 seconds)

```

2.3 Example Run Of Checkpoint Manager

This section shows a run through of the Checkpoint manager application using to demonstrate its usage. This run through is using the event three example files supplied for the C programming assignment.

2.3.1 Adding a Correct Time

For the first example, I am demonstrating how to check in an entrant at with a valid time at a valid node. Below is a screen image showing this:

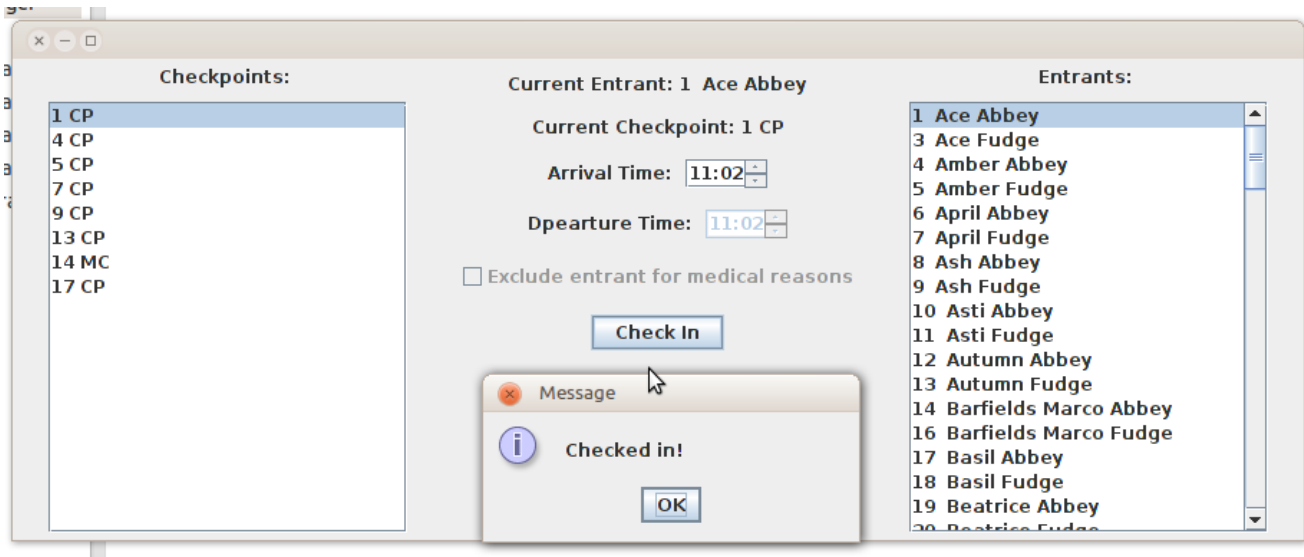


Figure 1: Checking in a valid entrant at a valid time.

2.3.2 Arriving at an Incorrect Node

This example shows attempting to check in the same entrant as in the previous step to the same node directly after signing them in. This results in an a notice that the entrant will be excluded for going the wrong way on their course.

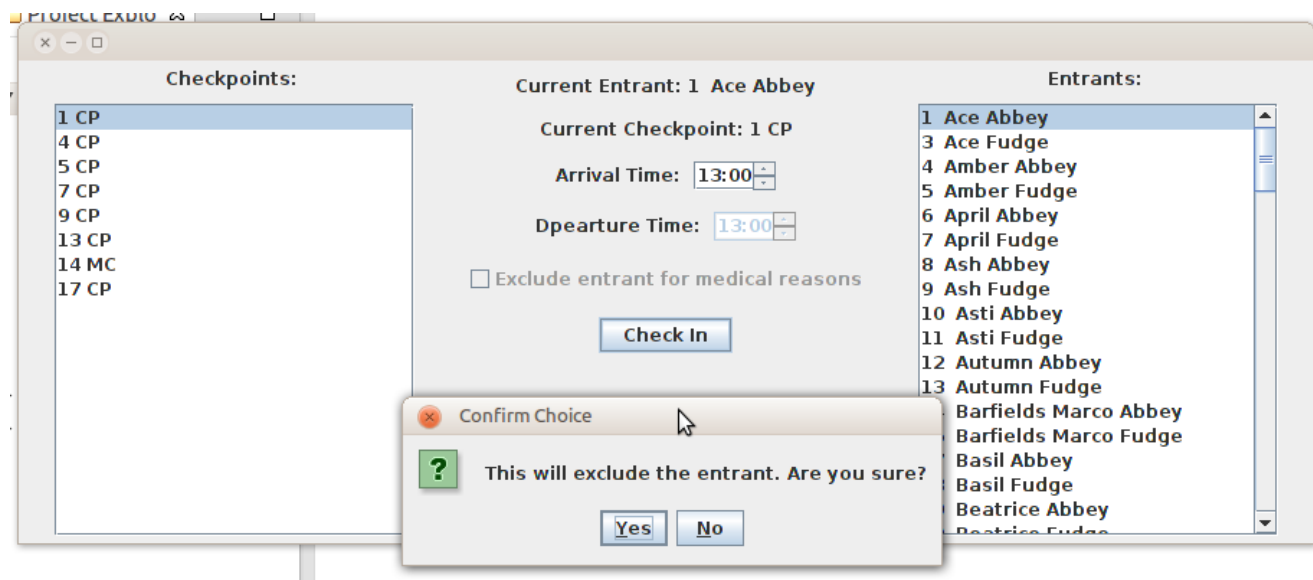


Figure 2: Checking in an entrant at an invalid node.

2.3.3 Arriving at Another Node at an Incorrect Time

The next example shows checking in an entrant to a valid node (node 4) but at an invalid time (e.g. at a time before the last node they we're checked in at).

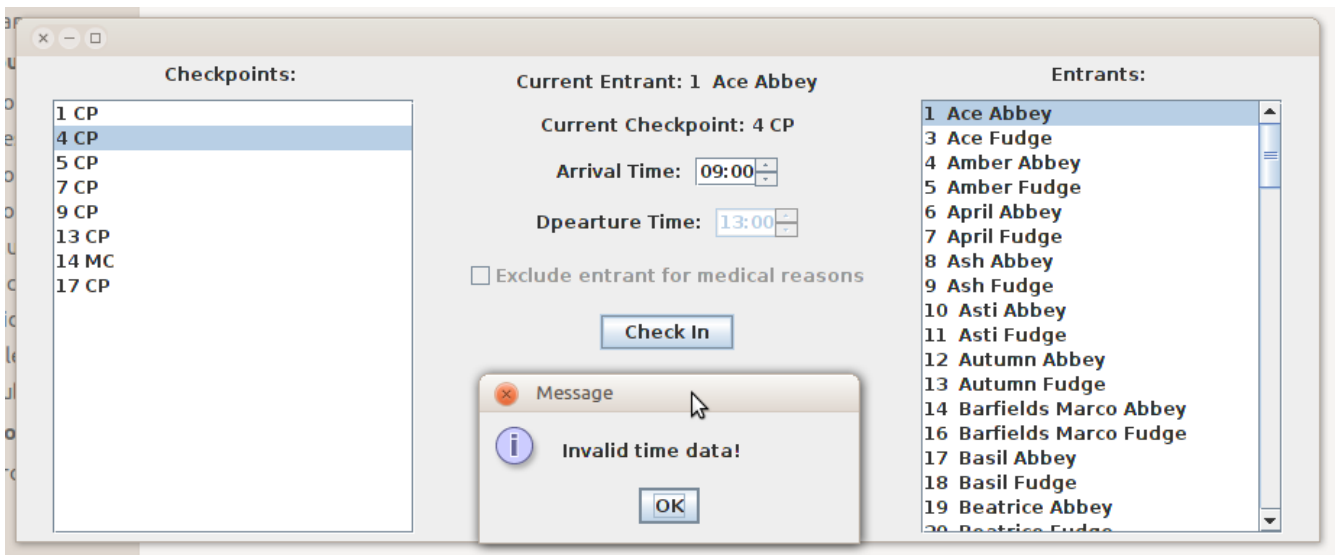


Figure 3: Checking in an entrant at a valid node but at an invalid time.

2.3.4 Checking into a Medical Checkpoint

The following example shows checking in an entrant to a medical checkpoint. Notice how the relevant parts of the form are no longer greyed out when the medical checkpoint is selected.

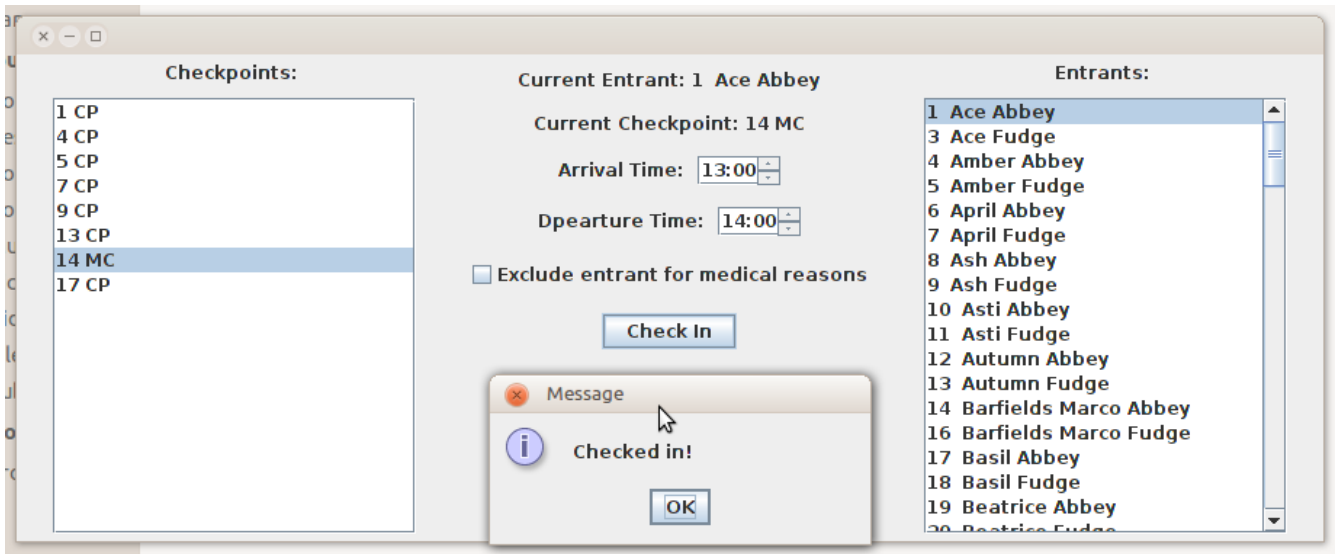


Figure 4: Checking in an entrant at a medical checkpoint using valid times.

2.3.5 Checking into a Medical Checkpoint with Incorrect Times

This example shows attempting to check an entrant into a medical checkpoint with a departure time that is before the arrival time.

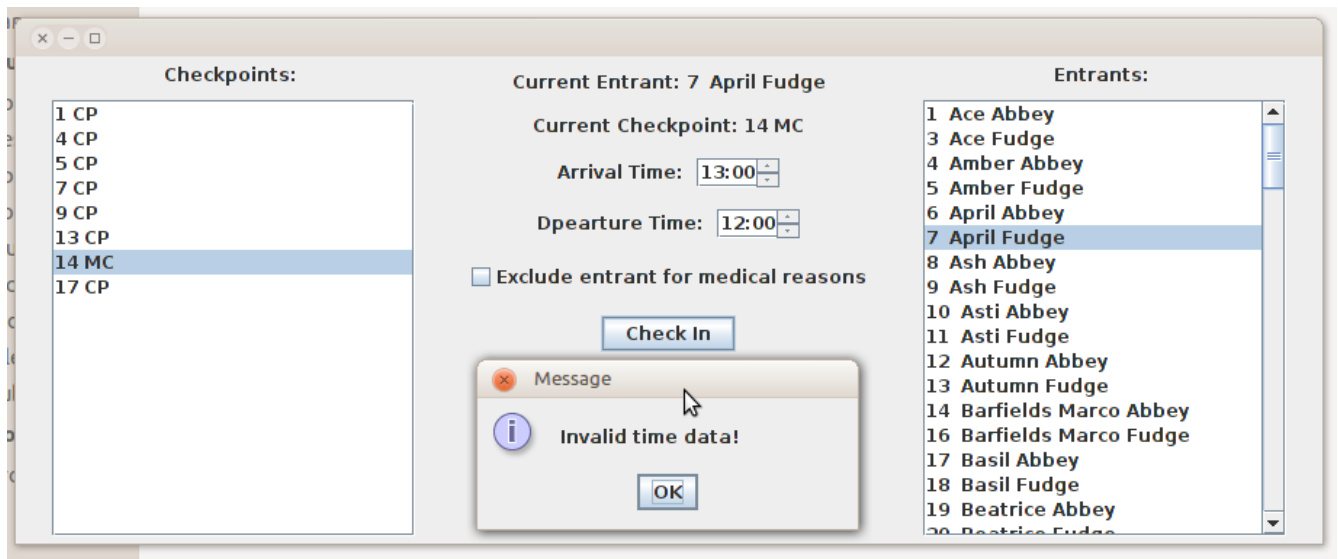


Figure 5: Checking in an entrant at a medical checkpoint but with invalid arrival/departure times.

2.3.6 Checking into a Medical Checkpoint and Excluding the Entrant

The following example demonstrates the user interface when the user chooses to exclude an entrant for medical reasons from the event. Note that excluding an entrant at a checkpoint for going the wrong way but not for medical reasons works the same as at a regular checkpoint.

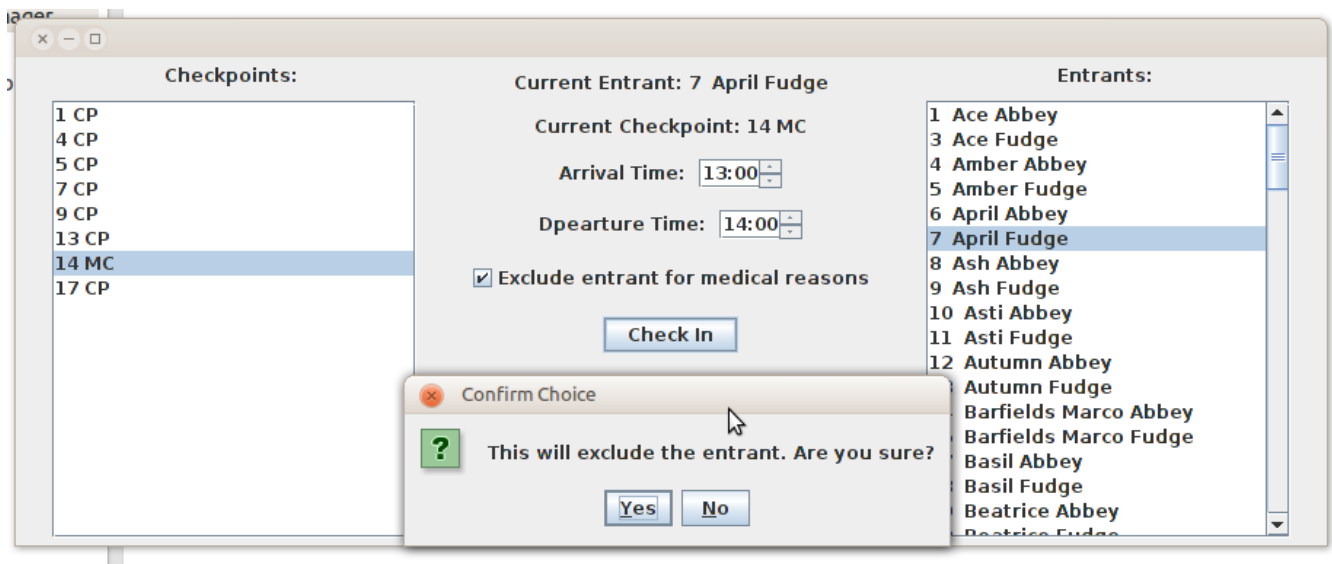


Figure 6: Checking in an entrant at a medical checkpoint and excluding them at the same time.

2.3.7 File Locking

The final screen image shows what happens when the application tries to read the times file when another application has it open for writing. To demonstrate this functionality, I had to have one version of the application running from a jar file and another version running in debug mode with a breakpoint on line 290 of listing 26 to prevent the file lock from releasing the lock on the file.

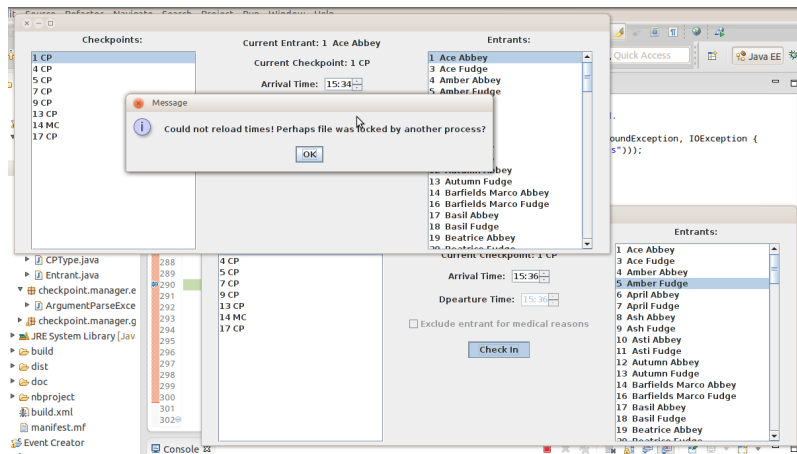


Figure 7: Demonstrating file locking works by putting a break point in the lower right hand side application to prevent the lock from releasing.

3 Event Manager Program Documentation

This section provides the documentation for the Event Manager program, written in C, including build logs and example output.

3.1 Compilation Output

Below is the full build log from the compilation of the Event Manager program.

Listing 29: Build log of the C Event Manager Program

```
12:27:50 **** Build of configuration Debug for project Event Manager ****
make all
Building file: ../fileio.c
Invoking: GCC C Compiler
gcc -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"fileio.d" -MT"fileio.d" -o "fileio.o" "../fileio.c"
Finished building: ../fileio.c

Building file: ../linked_list.c
Invoking: GCC C Compiler
gcc -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"linked_list.d" -MT"linked_list.d" -o "linked_list.o" "../linked_list.c"
Finished building: ../linked_list.c

Building file: ../main.c
Invoking: GCC C Compiler
gcc -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"main.d" -MT"main.d" -o "main.o" "../main.c"
Finished building: ../main.c

Building file: ../util.c
Invoking: GCC C Compiler
gcc -O0 -g3 -Wall -c -fmessage-length=0 -MMD -MP -MF"util.d" -MT"util.d" -o "util.o" "../util.c"
Finished building: ../util.c

Building target: Event Manager
Invoking: GCC C Linker
gcc -o "Event Manager" ./fileio.o ./linked_list.o ./main.o ./util.o
Finished building target: Event Manager

12:27:50 Build Finished (took 415ms)
```

3.2 Example Run Output

The following section shows the output generated from running the event manager program for each type of query a user can make with the system. This run was carried out using event one example files.

Listing 30: Output of an example run of the C program

```

=====|
|-----RUNNERS AND RIDERS-----|
|-----|
|-----Event tracking application-----|
|=====|

Loading data files...
Enter location and name of event details file:
../event_1/name.txt
Enter location and name of the nodes file:
../event_1/nodes.txt
Enter location and name of the tracks file:
../event_1/tracks.txt
Enter location and name of the courses file:
../event_1/courses.txt
Enter location and name of the entrants file:
../entrants.txt
Error opening file:
../entrants.txt
Enter location and name of the entrants file:
../event_1/entrants.txt
Enter location and name of the log file:
../event_1/log.txt
Enter location and name of the times file:
../event_1/cp.times.1.txt
Enter an Option:
0 - Exit
1 - Event Details
2 - Query Competitor
3 - Check how many competitors not yet started
4 - Check how many competitors are out on courses
5 - Check how many competitors have finished
6 - Print table of results
7 - Print entrants excluded at medical checkpoints
8 - Print entrants excluded at regular checkpoints
1
Endurance Horse Race - Beginners Event
26th June 2012
Start Time: 07:30
Enter an Option:
0 - Exit
1 - Event Details
2 - Query Competitor
3 - Check how many competitors not yet started
4 - Check how many competitors are out on courses
5 - Check how many competitors have finished
6 - Print table of results
7 - Print entrants excluded at medical checkpoints
8 - Print entrants excluded at regular checkpoints
2
Enter id for the competitor:
1
COMPETITOR 1:
Name: Donald Duck
Status: Out on track.
Last recorded time: 08:46
Last checkpoint visited: 9
Track Reference No.: 11
Presumed on track between node 3 and node 9
Enter an Option:
0 - Exit
1 - Event Details
```


2 – Query Competitor
 3 – Check how many competitors not yet started
 4 – Check how many competitors are out on courses
 5 – Check how many competitors have finished
 6 – Print table of results
 7 – Print entrants excluded at medical checkpoints
 8 – Print entrants excluded at regular checkpoints

3

0 competitors have not yet started

Enter an Option:

0 – Exit

1 – Event Details

2 – Query Competitor

3 – Check how many competitors not yet started

4 – Check how many competitors are out on courses

5 – Check how many competitors have finished

6 – Print table of results

7 – Print entrants excluded at medical checkpoints

8 – Print entrants excluded at regular checkpoints

4

13 competitors are out on a course

Enter an Option:

0 – Exit

1 – Event Details

2 – Query Competitor

3 – Check how many competitors not yet started

4 – Check how many competitors are out on courses

5 – Check how many competitors have finished

6 – Print table of results

7 – Print entrants excluded at medical checkpoints

8 – Print entrants excluded at regular checkpoints

5

0 competitors have completed their course

Enter an Option:

0 – Exit

1 – Event Details

2 – Query Competitor

3 – Check how many competitors not yet started

4 – Check how many competitors are out on courses

5 – Check how many competitors have finished

6 – Print table of results

7 – Print entrants excluded at medical checkpoints

8 – Print entrants excluded at regular checkpoints

6

 |Competitor | Course | Status | Start Time | End Time | MC Delay | Total |

Donald Duck	D	ON TRACK	07:30	N/a	N/a	N/a
Mickey Mouse	D	ON TRACK	07:35	N/a	N/a	N/a
Jemima Julieta Mouse	E	ON TRACK	07:39	N/a	N/a	N/a
Minnie Duck	F	ON TRACK	07:43	N/a	N/a	N/a
Minnie Mouse	E	ON TRACK	07:47	N/a	N/a	N/a
Minnie Mouse Junior	E	ON TRACK	07:51	N/a	N/a	N/a
Deputy Doug	D	ON TRACK	07:56	N/a	N/a	N/a
Deputy Duck	D	ON TRACK	08:01	N/a	N/a	N/a
Bewick Swan	F	ON TRACK	08:05	N/a	N/a	N/a
Black Swan	F	TIME CHECKPOINT	08:10	N/a	N/a	N/a
Albert Einstein	E	ON TRACK	08:14	N/a	N/a	N/a
Albert Mouse	D	ON TRACK	08:18	N/a	N/a	N/a
Donald Duck Senior	E	ON TRACK	08:22	N/a	N/a	N/a
Egbert Einstein	F	ON TRACK	08:26	N/a	N/a	N/a

Enter an Option:

0 – Exit

1 – Event Details

2 – Query Competitor

3 – Check how many competitors not yet started

4 – Check how many competitors are out on courses

5 – Check how many competitors have finished

6 – Print table of results

7 – Print entrants excluded at medical checkpoints

8 – Print entrants excluded at regular checkpoints

7

Competitors Excluded from Medical Checkpoints

```
-----
|Competitor | Node | Time |
|-----|
```

Enter an Option:

0 – Exit

1 – Event Details

2 – Query Competitor

3 – Check how many competitors not yet started

4 – Check how many competitors are out on courses

5 – Check how many competitors have finished

6 – Print table of results

7 – Print entrants excluded at medical checkpoints

8 – Print entrants excluded at regular checkpoints

8

Competitors Excluded from Regular Checkpoints

```
-----
|Competitor | Node | Time |
|-----|
```

Enter an Option:

0 – Exit

1 – Event Details

2 – Query Competitor

3 – Check how many competitors not yet started

4 – Check how many competitors are out on courses

5 – Check how many competitors have finished

6 – Print table of results

7 – Print entrants excluded at medical checkpoints

8 – Print entrants excluded at regular checkpoints

0

3.3 Example Run Results List

This sections show a listing of the results table for an event, including a selection of competitors in a variety of states (e.g. excluded, completed, not started etc.)

Listing 31: The results table. With competitors in various states

```
-----
|Competitor | Course | Status | Start Time | End Time | MC Delay | Total |
|-----|
|Donald Duck | D |COMPLETED | 15:32 | 19:32 | 00hrs 00mins | 04hrs 00mins |
|Mickey Mouse | D |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Jemima Julieta Mouse | E |COMPLETED | 15:35 | 18:35 | 00hrs 00mins | 03hrs 00mins |
|Minnie Duck | F |COMPLETED | 15:30 | 18:30 | 00hrs 00mins | 03hrs 00mins |
|Minnie Mouse | E |EXCLUDED IR | 00:00 | N/a | N/a | N/a |
|Minnie Mouse Junior | E |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Deputy Doug | D |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Deputy Duck | D |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Bewick Swan | F |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Black Swan | F |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Albert Einstein | E |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Albert Mouse | D |NOT STARTED | 00:00 | N/a | N/a | N/a |
|Donald Duck Senior | E |EXCLUDED IR | 00:00 | N/a | N/a | N/a |
|Egbert Einstein | F |NOT STARTED | 00:00 | N/a | N/a | N/a |
|-----|
```

3.4 Output Of Log File

Below is the output of the log file after using the Checkpoint and Event manager applications to create the previous output.

Listing 32: Output from the log file generated when creating the results shown in the listing 31

```
16:30 CMP: Read the times file.
16:31 CMP: Read the times file.
16:31 CMP: Checked in entrant 4 @ node 1
16:31 CMP: Read the times file.
16:31 CMP: Checked in entrant 4 @ node 9
16:31 CMP: Read the times file.
16:31 CMP: Checked in entrant 4 @ node 13
16:31 CMP: Read the times file.
16:31 CMP: Read the times file.
16:31 CMP: Checked in entrant 4 @ node 1
16:32 CMP: Read the times file.
16:32 CMP: Checked in entrant 1 @ node 1
16:32 CMP: Read the times file.
16:32 CMP: Checked in entrant 1 @ node 4
16:32 CMP: Read the times file.
16:32 CMP: Read the times file.
16:32 CMP: Checked in entrant 1 @ node 5
16:32 CMP: Read the times file.
16:32 CMP: Checked in entrant 1 @ node 9
16:32 CMP: Read the times file.
16:32 CMP: Checked in entrant 1 @ node 1
16:34 CMP: Read the times file.
16:34 CMP: Checked in entrant 3 @ node 1
16:34 CMP: Read the times file.
16:34 CMP: Read the times file.
16:34 CMP: Checked in entrant 3 @ node 9
16:34 CMP: Read the times file.
16:34 CMP: Checked in entrant 3 @ node 13
16:35 CMP: Read the times file.
16:35 CMP: Checked in entrant 3 @ node 1
16:43 CMP: Read the times file.
16:43 CMP: Read the times file.
16:43 CMP: Checked in entrant 5 @ node 4
16:44 CMP: Read the times file.
16:44 CMP: Checked in entrant 13 @ node 4
16:45 EMP: Loaded the times file.
16:45 EMP: Viewed a list of results
16:45 EMP: Loaded the times file.
```

4 Outline of Programs

4.1 Event Creation Program

The event creation program is a command line based application written in C++. Its purpose is to create the event, courses and entrants file for each event. The design of the application allows the user to create multiple events at the same time, rather than having to make each event in serial. Because entrants need a course and a course needs an event, an event must be created before a course and a course must be created before an entrant. This includes the functionality to create different course and entrants associated with different events. Each event also expects a nodes file to be given when creating the event, allowing different events to work with different sets of allowed nodes. The user is also able to view an event by selecting the relevant option from the main menu.

Since lists of courses and entrants are associated with each event, I decided that the best approach would be to allow the user to create all the data about an event, then write it to file, rather than creating each of the files one at a time. When the user chooses the option to write an event, a new folder is created with the name of the event as the name of the folder. Inside the folder, the event, entrants and courses files are written.

Note that as the brief made no mention of courses relying on the input of the tracks file, I have assumed that the tracks file is generated from the courses file and not visa versa. Integration of the creation of the tracks file alongside courses might be a nice enhancement in any future development.

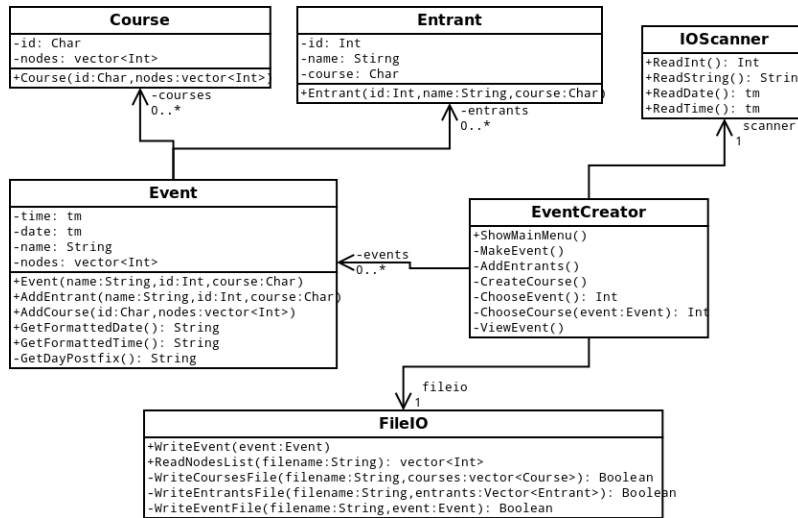


Figure 8: Class diagram of the Event Creator program. Getters/Setters not shown.

4.2 Checkpoint Manager Program

The checkpoint manager program is written in Java and provides a Swing based GUI to allow the user to easily update entrants out in the field as the JVM allows the program to be executed on a variety of platforms. This program accepts the required files (entrants, courses, nodes, time and log files) as command line arguments using flags for each file. Help instructions are printed when no arguments or incorrect arguments are supplied. An example listing of arguments is supplied below:

```
java -jar checkpoint_manager.jar -E ../../event_3/entrants.txt -C ../../event_3/courses.txt -K ../../event_3/nodes.txt
-T ../../event_3/times.txt -L ../../event_3/log.txt
```

The checkpoint manager program allows a race marshal to update the location of the entrants as they arrive at the various checkpoints on the course. Entrants are automatically excluded if checked into a checkpoint they should not

of visited. The GUI also provides an option for marshals to excluded entrants based on failing a medical checkpoint. When an entrant is excluded, they are automatically removed from the list of available entrants. When an entrant is about to be excluded, the user is asked to confirm the operation, ensuring that they don't accidentally excluded a competitor.

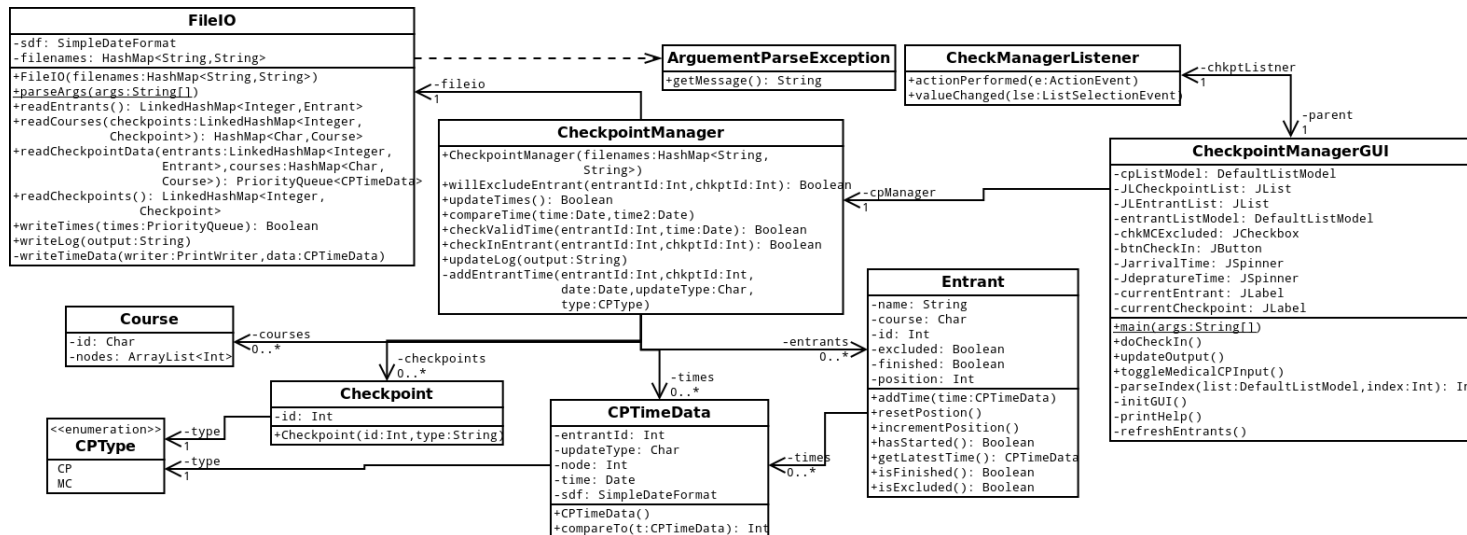


Figure 9: Class diagram of the Checkpoint Manager program. Getters/Setters not shown.

The event manager program allows the user to input the time a competitor arrives and, in the case of medical checkpoints, departs. The program automatically checks that the arrival time is greater than the last time the entrant was checked in. In the case of medical checkpoints, it also checks that the arrival time is not greater than the departure time. Correct order of times is tracked using a priority queue.

One small note on the design of the Java program is that I would of liked to have implemented the GUI to better adhere to the model view controller design principles as I feel this would have made for a cleaner communication model between the GUI and data model.

4.3 Event Manager Program

The event manager program is written in C and handles checking the position and state of entrants as they progress through a course. This application has changed only slightly from the previous C assignment. Changes include removal of manual entry, automatically reloading the times file, file locking and writing to the log file. Major functions include viewing a list of which entrants have been excluded, finished and are currently out on a track. It also gives the user the ability to query individual competitors and provides an estimate of what track/node they should/are on.

The event manager requires the loading of all the data files for an event. This is done by prompting the user at the start of the application and only needs to be done once. Like the event manager, the application locks the log and times file when reading to prevent multiple applications crashing during file processing.

4.4 Summary

In summary of the three programs, I feel that they all adequately achieve the aims laid out in the brief, although I also strongly feel that there is plenty of room for improvement. One of the largest areas that could be improved would be better design of the file reading and writing, functions to intelligently handle badly formed files when parsing. The C and Java programs could also be improved to better handle the when trying to read/write to a locked file than simply throwing an error message.