```java
package mts;

class Severity {
    SeverityLevel severity = SeverityLevel.Urgent;

    //@ requires severity != null;
    //@ ensures this.severity == s;
    void setSeverityLevel(SeverityLevel s) { this.severity = s; }

    //@ ensures \result == severity;
    /*@ pure @*/ SeverityLevel getSeverityLevel() { return severity; }

    //@ requires p.obtain_patient_info == true;
    //@ ensures p.examined_airway == true;
    void examineAirway(TreatedPatient p) {
        System.out.println("Examining patient's airway");
        if (p.obtain_patient_info == true) {
            if (p.airwayCompromise == true) {
                System.out.println("\tPatient's airway is compromised");
                setSeverityLevel(SeverityLevel.Immediate);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tSupervise patient\n");
            }
            p.examined_airway = true;
        } else {
            System.out.println("*** Obtain patient information before examination of airway ***\n");
        }
    }

    //@ requires p.examined_airway == true;
    //@ ensures p.examined_breathing == true;
    void checkForAdequateBreathing(TreatedPatient p) {
        System.out.println("Checking for adequate breathing");
        if (p.examined_airway == true) {
            if (p.inadequateBreathing == true) {
                System.out.println("\tPatient has inadequate breathing");
                setSeverityLevel(SeverityLevel.Immediate);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tSupervise patient\n");
            }
            p.examined_breathing = true;
        } else {
            System.out.println("*** Examine patient's airway before checking for adequate breathing ***\n");
        }
    }

    //@ requires p.examined_airway == true || p.examined_breathing == true;
    //@ ensures p.checked_patient_for_shock == true;
    void checkForShock(TreatedPatient p) {
        System.out.println("Checking for signs of shock");
        if (p.examined_airway == true || p.examined_breathing == true) {
            if (p.shock == true) {
                System.out.println("\tPatient shows signs of shock");
                setSeverityLevel(SeverityLevel.Immediate);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tSupervise patient\n");
            }
            p.checked_patient_for_shock = true;
        } else {
            System.out.println("*** Examine airway or breathing before checking for signs of shock ***\n");
        }
    }

    //@ requires p.checked_patient_for_shock == true;
    //@ ensures p.pain_measured == true;
    void measurePain(TreatedPatient p) {
        System.out.println("Measuring levels of pain");
        if (p.checked_patient_for_shock == true) {
            if (p.severePain == true) {
                System.out.println("\tPatient is in severe pain");
                setSeverityLevel(SeverityLevel.VeryUrgent);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else if (p.moderatePain == true ) {
                System.out.println("\tPatient is in moderate pain");
                setSeverityLevel(SeverityLevel.Urgent);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
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        } else if (p.minorPain == true) {
            System.out.println("\tPatient is in minor pain");
            setSeverityLevel(SeverityLevel.Standard);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else {
            System.out.println("\tSupervise patient\n");
        }
        p.pain_measured = true;
    } else {
        System.out.println("*** Check patient for shock before measuring pain ***\n");
    }
}

//@ requires p.pain_measured == true;
//@ ensures p.cardiac_pain_examined == true;
void examineCardiacPain(TreatedPatient p) {
    System.out.println("Examination for cardiac pain");
    if (p.pain_measured == true) {
        if (p.cardiacPain == true) {
            System.out.println("\tPatient has cardiac pain");
            setSeverityLevel(SeverityLevel.Urgent);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else {
            System.out.println("\tSupervise patient\n");
        }
        p.cardiac_pain_examined = true;
    } else {
        System.out.println("*** Measure levels of pain before examination of cardiac pain ***\n");
    }
}

//@ requires p.pain_measured == true && p.cardiac_pain_examined == true;
//@ ensures p.breathing_rate_measured == true;
void measureBreathingRate(TreatedPatient p) {
    System.out.println("Measuring patient's breathing rate");
    if (p.pain_measured == true && p.cardiac_pain_examined == true) {
        if (p.inadequateBreathing == true) {
            System.out.println("\tPatient has inadequate breathing");
            setSeverityLevel(SeverityLevel.Immediate);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else if (p.acutelyShortBreath == true) {
            System.out.println("\tPatient has acute breathing rate");
            setSeverityLevel(SeverityLevel.VeryUrgent);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else if (p.normalBreathing == true) {
            System.out.println("\tPatient has normal breathing rate");
            setSeverityLevel(SeverityLevel.Standard);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else {
            System.out.println("\tSupervise patient\n");
        }
        p.breathing_rate_measured = true;
    } else {
        System.out.println("*** Measure levels of pain and examine for cardiac pain before measuring breathing rate ***\n");
    }
}

//@ requires p.pain_measured == true && p.cardiac_pain_examined == true && p.breathing_rate_measured == true;
//@ ensures p.pulse_checked == true;
void checkPulse(TreatedPatient p) {
    System.out.println("Checking patient's pulse");
    if (p.pain_measured == true && p.cardiac_pain_examined == true && p.breathing_rate_measured == true) {
        if (p.abnormalPulse == true) {
            System.out.println("\tPatient has abnormal pulse");
            setSeverityLevel(SeverityLevel.VeryUrgent);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else if (p.normalPulse == true) {
            System.out.println("\tPatient has normal pulse");
            setSeverityLevel(SeverityLevel.Standard);
            System.out.println("\t\t=> " + getSeverityLevel() + "\n");
        } else {
            System.out.println("\tSupervise patient\n");
        }
        p.pulse_checked = true;
    } else {
        System.out.println("*** Measure levels of pain, examine for cardiac pain and breathing rate before checking for pulse ***\n"
        );
    }
}
```

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158
159     //@ requires p.pulse_checked == true;
160     //@ ensures p.pleuritic_pain_examined == true;
161     void examinePleuriticPain(TreatedPatient p) {
162         System.out.println("Checking for pleuritic pain");
163         if (p.pulse_checked == true) {
164             if (p.pleuriticPain == true) {
165                 System.out.println("\tPatient has pleuritic pain");
166                 setSeverityLevel(SeverityLevel.Urgent);
167                 System.out.println("\t\t=> " + getSeverityLevel() + "\n");
168             } else {
169                 System.out.println("\tSupervise patient\n");
170             }
171             p.pleuritic_pain_examined = true;
172         } else {
173             System.out.println("*** Check patient's pulse before examination for pleuritic pain ***\n");
174         }
175     }
176
177     //@ requires p.pleuritic_pain_examined == true;
178     //@ ensures p.checked_for_persistent_vomiting == true;
179     void checkForPersistentVomiting(TreatedPatient p) {
180         System.out.println("Checking for persistent vomiting");
181         if (p.pleuritic_pain_examined == true) {
182             if (p.persistentVomiting == true) {
183                 System.out.println("\tPatient has persistent vomiting");
184                 setSeverityLevel(SeverityLevel.Urgent);
185                 System.out.println("\t\t=> " + getSeverityLevel() + "\n");
186             } else {
187                 System.out.println("\tSupervise patient\n");
188             }
189             p.checked_for_persistent_vomiting = true;
190         } else {
191             System.out.println("*** Check for pleuritic pain before checking for persistent vomiting ***\n");
192         }
193     }
194
195     //@ requires p.pleuritic_pain_examined == true && p.checked_for_persistent_vomiting == true;
196     //@ ensures p.examine_patients_cardiac_history == true;
197     void examineForCardiacHistory(TreatedPatient p) {
198         System.out.println("Checking for patient's cardiac history");
199         if (p.pleuritic_pain_examined == true && p.checked_for_persistent_vomiting == true) {
200             if (p.significantCardiacHistory == true) {
201                 System.out.println("\tPatient has significant cardiac history");
202                 setSeverityLevel(SeverityLevel.Urgent);
203                 System.out.println("\t\t=> " + getSeverityLevel() + "\n");
204             } else {
205                 System.out.println("\tSupervise patient\n");
206             }
207             p.examine_patients_cardiac_history = true;
208         } else {
209             System.out.println("*** Check for pleuritic pain and persistent vomiting before examination of cardiac history ***\n");
210         }
211     }
212
213     //@ requires p.pleuritic_pain_examined == true && p.checked_for_persistent_vomiting == true &&
        p.examine_patients_cardiac_history == true;
214     //@ ensures p.pain_remeasured == true;
215     void remeasureForPain(TreatedPatient p) {
216         System.out.println("Remeasuring patient's levels of pain");
217         if (p.pleuritic_pain_examined == true && p.checked_for_persistent_vomiting == true && p.examine_patients_cardiac_history
            == true) {
218             measurePain(p);
219             p.pain_remeasured = true;
220         } else {
221             System.out.println("*** Check for pleuritic pain, persistent vomiting, and examine patient's cardiac history before
            remeasuring levels of pain ***\n");
222         }
223     }
224
225     //@ requires p.pain_remeasured == true;
226     //@ ensures p.vomiting_checked == true;
227     void checkVomiting(TreatedPatient p) {
228         System.out.println("Checking for vomiting");
229         if (p.pain_remeasured == true) {
230             if (p.recentVomiting == true) {
231                 System.out.println("\tPatient has recent vomiting");
232                 setSeverityLevel(SeverityLevel.Standard);
233                 System.out.println("\t\t=> " + getSeverityLevel() + "\n");
```

```
234             } else {
235                 System.out.println("\tSupervise patient\n");
236             }
237             p.vomiting_checked = true;
238         } else {
239             System.out.println("*** Remeasure patient's levels of pain before checking for vomiting ***\n");
240         }
241     }
242 
243     //@ requires p.vomiting_checked == true;
244     //@ ensures p.mild_pain_examined == true;
245     void examineForMildPain(TreatedPatient p) {
246         System.out.println("Checking for recent mild pain");
247         if (p.vomiting_checked == true) {
248             if (p.recentMildPain == true) {
249                 System.out.println("\tPatient has recent mild pain");
250                 setSeverityLevel(SeverityLevel.Standard);
251                 System.out.println("\t\t=> " + getSeverityLevel() + "\n");
252             } else {
253                 System.out.println("\tSupervise patient\n");
254             }
255             p.mild_pain_examined = true;
256         } else {
257             System.out.println("*** Check for vomiting before examination of recent mild pain ***\n");
258         }
259     }
260 
261     //@ requires p.vomiting_checked == true && p.mild_pain_examined == true;
262     //@ ensures p.problems_checked == true;
263     void checkForProblems(TreatedPatient p) {
264         System.out.println("Checking for recent problems");
265         if (p.vomiting_checked == true && p.mild_pain_examined == true) {
266             if (p.recentProblem == true) {
267                 System.out.println("\tPatient has recent problem");
268                 setSeverityLevel(SeverityLevel.Standard);
269                 System.out.println("\t\t=> " + getSeverityLevel() + "\n");
270             } else {
271                 System.out.println("\tSupervise patient\n");
272             }
273             p.problems_checked = true;
274         } else {
275             System.out.println("*** Check for vomiting and examine for recent mild pain before checking for recent problems ***\n");
276         }
277     }
278 }
279 
```

```java
package esi;

class Severity {
    SeverityLevel severity = SeverityLevel.Urgent;

    //@ requires severity != null;
    //@ ensures this.severity == severity;
    void setSeverityLevel(SeverityLevel severity) { this.severity = severity; }

    //@ ensures \result == severity;
    /*@ pure @*/ SeverityLevel getSeverityLevel() { return severity; }

    //@ requires p.obtain_patient_info == true;
    //@ ensures p.checked_for_immediate_intervention == true;
    void checkIfInterventionNeeded(TreatedPatient p) {
        System.out.println("Check if immediate intervention is required");
        if (p.obtain_patient_info == true) {
            if (p.requiresLifeSavingIntervention == true) {
                System.out.println("\tPatient requires life saving intervention");
                setSeverityLevel(SeverityLevel.Immediate);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tPatient does not require life saving intervention\n");
            }
            p.checked_for_immediate_intervention = true;
        } else {
            System.out.println("*** Obtain patient information before checking if intervention is needed ***\n");
        }
    }

    //@ requires p.checked_for_immediate_intervention == true;
    //@ ensures p.situation_assessed == true;
    void assessSituation(TreatedPatient p) {
        System.out.println("Assess patient's situation");
        if (p.checked_for_immediate_intervention == true) {
            if (p.highRiskSituation == true) {
                System.out.println("\tPatient is in high risk situation");
                setSeverityLevel(SeverityLevel.VeryUrgent);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tPatient is not in high risk situation\n");
            }
            p.situation_assessed = true;
        } else {
            System.out.println("*** Check for immediate intervention before assessing situation ***\n");
        }
    }

    //@ requires p.situation_assessed == true;
    //@ ensures p.examined_if_confused == true || p.examined_if_disoriented == true || p.examined_if_lethargic == true;
    void examine(TreatedPatient p) {
        System.out.println("Examine patient");
        if (p.situation_assessed == true) {
            if (p.confused == true) {
                System.out.println("\tPatient is confused");
                setSeverityLevel(SeverityLevel.VeryUrgent);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tPatient is not confused\n");
            }
            p.examined_if_confused = true;

            if (p.disoriented == true) {
                System.out.println("\tPatient is disoriented");
                setSeverityLevel(SeverityLevel.VeryUrgent);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tPatient is not disoriented\n");
            }
            p.examined_if_disoriented = true;

            if (p.lethargic == true) {
                System.out.println("\tPatient is lethargic");
                setSeverityLevel(SeverityLevel.VeryUrgent);
                System.out.println("\t\t=> " + getSeverityLevel() + "\n");
            } else {
                System.out.println("\tPatient is not lethargic\n");
            }
            p.examined_if_lethargic = true;
```

```
80      } else {
81          System.out.println("*** Assess situation before examination ***\n");
82      }
83  }
84
85  //@ requires p.situation_assessed == true;
86  //@ requires p.examined_if_confused == true || p.examined_if_disoriented == true || p.examined_if_lethargic == true;
87  //@ ensures p.checked_if_severe_pain == true || p.checked_if_distressed == true;
88  void checkForPain(TreatedPatient p) {
89      System.out.println("Check for severe pain or distress");
90      if (p.situation_assessed == true && (p.examined_if_confused == true || p.examined_if_disoriented == true || p.
        examined_if_lethargic == true)) {
91          if (p.severePain == true) {
92              System.out.println("\tPatient is in severe pain");
93              setSeverityLevel(SeverityLevel.VeryUrgent);
94              System.out.println("\t\t=> " + getSeverityLevel() + "\n");
95          } else {
96              System.out.println("\tPatient is not in severe pain\n");
97          }
98          p.checked_if_severe_pain = true;
99
100         if (p.distress == true) {
101             System.out.println("\tPatient is in distress");
102             setSeverityLevel(SeverityLevel.VeryUrgent);
103             System.out.println("\t\t=> " + getSeverityLevel() + "\n");
104         } else {
105             System.out.println("\tPatient is not in distress\n");
106         }
107         p.checked_if_distressed = true;
108     } else {
109         System.out.println("*** Assess situation and examine if patient is either confused, disoriented, or lethargic before checking
            for pain ***\n");
110     }
111 }
112
113 //@ requires (p.checked_if_severe_pain == true || p.checked_if_distressed == true) && p.resources > 0;
114 //@ ensures p.number_resources_assessed == true;
115 void checkResourcesNeeded(TreatedPatient p) {
116     System.out.println("Check required resources");
117     if ((p.checked_if_severe_pain == true || p.checked_if_distressed == true) && p.getResourcesRequired() > 0) {
118         if (p.getResourcesRequired() == 0) {
119             System.out.println("\tPatient does not need resources");
120             setSeverityLevel(SeverityLevel.Delayed);
121             System.out.println("\t\t=> " + getSeverityLevel() + "\n");
122         } else if (p.getResourcesRequired() == 1) {
123             System.out.println("\tPatient needs only one resource");
124             setSeverityLevel(SeverityLevel.Minor);
125             System.out.println("\t\t=> " + getSeverityLevel() + "\n");
126         } else if (p.getResourcesRequired() > 1) {
127             System.out.println("\tPatient needs more than one resource\n");
128             p.number_resources_assessed = true;
129             measureVitalZones(p);
130         }
131         p.number_resources_assessed = true;
132     } else {
133         System.out.println("*** Check for severe pain or distress before checking resources needed ***\n");
134     }
135 }
136
137 // Age is set to int (years), SaO2 % levels as int
138 //@ requires p.number_resources_assessed == true && p.resources > 1;
139 //@ ensures p.vitals_examined == true;
140 private void measureVitalZones(TreatedPatient p) {
141     System.out.println("\tMeasure vital signs");
142     if (p.number_resources_assessed == true && p.getResourcesRequired() > 1) {
143         if (p.getAge() < 1) {
144             if (p.getHeartRate() >= 180 && p.getRespiratoryRate() >= 50 && p.getSaO2Level() < 92) {
145                 setSeverityLevel(SeverityLevel.VeryUrgent);
146             }
147         } else if (p.getAge() >= 1 && p.getAge() < 3) {
148             if ((p.getHeartRate() >= 160 && p.getHeartRate() < 180) && (p.getRespiratoryRate() >= 40 && p.getRespiratoryRate() <
                50) && (p.getSaO2Level() < 92)) {
149                 setSeverityLevel(SeverityLevel.VeryUrgent);
150             }
151         } else if (p.getAge() >= 3 && p.getAge() < 8) {
152             if ((p.getHeartRate() >= 140 && p.getHeartRate() < 160) && (p.getRespiratoryRate() >= 30 && p.getRespiratoryRate() <
                40) && (p.getSaO2Level() < 92)) {
153                 setSeverityLevel(SeverityLevel.VeryUrgent);
154             }
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155         } else if (p.getAge() >= 8) {
156             if ((p.getHeartRate() >= 100 && p.getHeartRate() < 140) && (p.getRespiratoryRate() >= 10 && p.getRespiratoryRate() <
                30) && (p.getSaO2Level() < 92)) {
157                 setSeverityLevel(SeverityLevel.VeryUrgent);
158             }
159         } else {
160             System.out.println("\tReassess vital signs\n");
161         }
162         p.vitals_examined = true;
163         System.out.println("\t\t=> " + getSeverityLevel() + "\n");
164       } else {
165         System.out.println("*** Check resource assessment and verify if patient needs more than one resource ***\n");
166       }
167     }
168 }
169
```