# Requirements

## Jourdan Harvey

### Cars coming from any direction must be able to pass through the intersection

Notes: Liveness

CTL: AG(car\_approaching\_intersection -> AF(car\_crossing\_intersection))

JPF-APROP: Unpresentable

### Pedestrians coming from any direction must be able to pass through the intersection

Notes: Liveness

CTL: AG(pedestrian\_approaching\_intersection -> AF(pedestrian\_crossing\_intersection))

JPF-APROP: Unpresentable

### A car waiting directly at a red light should not wait for more than 30s

Notes: Non-functional requirement

CTL: AG((light\_red\_NS && count\_cars > 0) || (light\_red\_EW && count\_cars > 0) -> (time\_waiting <= 30))

JPF-APROP: Unpresentable

### No car is leader for more than 30s

Notes: Non-functional requirement

CTL: AG(car\_is\_leader -> (time\_as\_leader <= 30))

JPF-APROP: @Invariant( "beenLeader <= 30" )

### If a car is leader it must be a VTL car

Notes: Functional requirement

CTL: AG(car\_is\_leader -> (car\_type == VTL))

JPF-APROP: Unpresentable

### No cars crossing EW while cars crossing NS

Notes: Safety

CTL: AG(cars\_crossing\_NS -> !cars\_crossing\_EW)

JPF-APROP: Unpresentable

### No cars crossing NS while cars crossing EW

Notes: Safety

CTL: AG(cars\_crossing\_EW -> !cars\_crossing\_NS)

JPF-APROP: Unpresentable

### While in VTL+ mode the traffic lights must always be green

Notes: Functional requirement

CTL: AG((mode == VTL) -> (light\_green\_NS && light\_green\_EW))

JPF-APROP: @Invariant( "((currentMode==1) || (((NColor != 0) || (EColor != 0)) && (currentMode != 1)))" )

### While in VTL+ mode there are no Normal cars

Notes: Safety

CTL: AG((mode == VTL) -> (count\_NORMAL\_cars == 0))

JPF-APROP: @Invariant(“(currentMode == 1 && hasNonVTLSum == 0 && hasPeds == 0)”)

### While in Normal Mode there are no VTL cars or there are conflicting non-VTL cars

Notes: Safety

CTL: AG((mode == NORMAL) -> (count\_VTL\_cars==0 || (count\_normal\_cars\_approaching\_EW > 0 && count\_normal\_cars\_approaching\_NS > 0)))

JPF-APROP: Unpresentable.

### While in Normal Mode at least one light must be red at all times

Notes: Safety

CTL: AG((mode == NORMAL) -> (light\_red\_NS || light\_red\_EW))

JPF-APROP: @Invariant( "((currentMode == 0) && ((NColor == 2) || (NColor != 2 && EColor == 2)))" )

### If there are pedestrians crossing the system should be in Normal mode

Notes: Functional requirement

CTL: AG((pedestrians\_crossing > 0) -> (mode == NORMAL))

JPF-APROP: @Invariant(“(currentMode == 0 && hasPeds == 1)”)

### If there are conflicting non-VTL cars then the system should be in Normal mode

Notes: Functional requirement

CTL: AG((count\_normal\_cars\_approaching\_EW > 0 && count\_normal\_cars\_approaching\_NS > 0) -> (mode==NORMAL))

JPF-APROP: @Invariant(“(currentMode == 0 && hasNonVTLSum == 2)”)

### While in mixed mode there should be at least one non-VTL car

Notes: Functional requirement

CTL: AG((mode == MIXED) -> (count\_normal\_cars > 0))

JPF-APROP: Unpresentable

### If there are Non conflicting, Non VTL cars present, as well as VTL Cars then the system should be in mixed mode

Notes: Functional requirement

CTL: AG((count\_VTL\_cars>0) && (count\_NORMAL\_cars>0) && ( (count\_normal\_cars\_approaching\_NS == 0) || ( count\_normal\_cars\_approaching\_EW == 0)) -> (mode == MIXED))

JPF-APROP: Unpresentable

### Cars should only be crossing if the light is not red

Notes: Safety

CTL: AG((cars\_crossing\_NS -> !light\_red\_NS) || (cars\_crossing\_EW -> !light\_red\_EW))

JPF-APROP: @Invariant( "distanceFromIntersection >= 0 || lightColor != 2" )

### The time that pedestrians have to cross should be shorter than the time that the direction is green for.

Notes: Safety

CTL: AG(pedestrian\_time\_to\_cross < green\_phase\_length)

JPF-APROP: Unpresentable

# Notes for JPF-APROP

### currentMode:

1. Normal Mode
2. VTL mode
3. Mixed Mode

### Light colors:

1. Green
2. Orange
3. Red