

ECE 321: Software Requirements Engineering

Assignment 3

Arun Woosaree

XXXXXXX

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Axioms begin on next page

algebra QueueOfCars

imports Integer, Boolean;
introduces

sorts Queue, Car;

operations

New: \rightarrow Queue;
CarArrives: Car x Queue \rightarrow Queue;
CarDeparts: Queue \rightarrow Queue;
IsEmpty: Queue \rightarrow Boolean;
NumberOfCars: Queue \rightarrow Integer;
Longer: Queue x Integer \rightarrow Boolean;
FirstCar: Queue \rightarrow Car;
Equal: Queue x Queue \rightarrow Boolean;
WhichQueue: Queue x Queue x Car \rightarrow Integer;
Position: Car x Queue \rightarrow Integer;

constrains New, CarArrives, CarDeparts, IsEmpty, NumberOfCars, Longer,
FirstCar, Equal, WhichQueue, Position, so that Queue generated by
[New, CarArrives]

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for all [q:Queue, q1:Queue, c:Car, c1:Car i:Integer]

  CarDeparts(New) = error;
  CarDeparts(CarArrives(c,q)) =
    if IsEmpty(q) then q;
    else CarArrives(c,CarDeparts(q));

  IsEmpty(New) = true;
  IsEmpty(CarArrives(c,q)) = false;
  NumberOfCars(New) = 0;
  NumberOfCars(CarArrives(c,q)) = NumberOfCars(q) + 1;
  Longer(New, i) = false;
  Longer(CarArrives(c,q), i) =
    if (i < NumberOfCars(q) + 1) then true;
    else false;

  FirstCar(New) = error;
  FirstCar(CarArrives(c,q)) =
    if IsEmpty(q) then c;
    else FirstCar(q);

  Equal(New, New) = true;
  Equal(CarArrives(c,q), New) = false;
  Equal(New, CarArrives(c,q)) = false;
  Equal(CarArrives(c,q), CarArrives(c1,q1)) =
    if (NumberOfCars(q) == NumberOfCars(q1)) then true;
    else false;

  WhichQueue(New, New, c) = 0;
  WhichQueue(New, CarArrives(c,q), c1) =
    if (Position(c1,q > -1) then 2;
    else 0;

  WhichQueue(CarArrives(c,q), New, c1) =
    if (Position(c1,q > -1) then 1;
    else 0;

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WhichQueue(CarArrives(c,q), CarArrives(c1,q1), c2) =
    if Position(c2,q) > -1 then 1;
    else if Positon(c2, q1) > -1 then 2;
    else 0;
Position(c, New) = -1;
Position(c1, CarArrives(c,q)) =
    if (c1 == c) then NumberOfCars(q);
    else Position(c1,q);
end QueueOfCars

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