COURSE TITLE: **Formal Methods in Software Engineering**   COURSE CODE: **SEN - 323**
CLASS: **BSE-5(A, B)**   SHIFT: **Morning**
INSTRUCTOR: **ENGR. AMMARAH KHALID**   DATE: **25ᵗʰ Oct 2023**
MAX. MARKS: **10**

ASSIGNMENT # 02 [CLO - 2]

Use the online Z-editor (https://z-editor.github.io/) to perform the following tasks:

1. **TASK # 01:** Refer to the Document control system given in the book **"The way of Z"** by Jonathan Jacky**,** define the normal *Checkin* operation, and a total *TCheckIn* operation that accounts for the exceptional cases in Document Control System.

2. **TASK # 02:** Consider the following scenario based on air-traffic control system :
   The air-traffic control of an airport keeps a record of the planes waiting to land and the assignment of planes to gates on the ground. There are operations to accept a plane when it arrives in the airport's waiting Space, to assign a plane to a gate at the airport and to record that a plane leaves its gate.

 | | |
   |---|---|
   | PLANE | ::= the set of all possible, uniquely identified planes |
   | GATE | ::=the set of all gates at this airport |
   | RESULT | ::= OK \| full badAircraft \| notWaiting \| gateNotFree \| notAtGate |

*AIRPORT*_____

waiting: $\mathbb{P}$ PLANE

assignment: GATE $\rightarrowtail$ PLANE
_____

waiting $\cap$ ran assignment = $\emptyset$
_____

Each plane is assigned to at most one gate and each gate has at most one plane assigned to it; so the assignment of planes to gates is an injective (one-to-one) function from gate to plane. The planes waiting are a set of planes (they are in no Particular Order) no plane is both waiting and assigned to a gate.
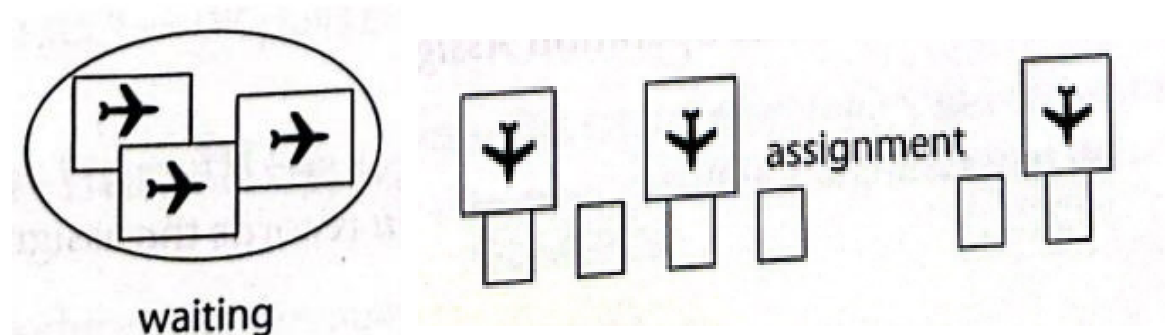
waiting   assignment

Write the following robust operational schemas:

1. **Arrival of plane**
   ArriveTotal == Arrive ∨ ArriveErr
   Arrive records the arrival of a plane in the airport's waiting area. The plane must be neither already waiting nor assigned to a gate.

2. **Assignment of plane**
   AssignTotal == Assign ∨ AssignErr
   Assign records the assignment of a plane to a free gate. The plane must be waiting and the gate must be free. The pairing between gate and plane is added to assignment. Plane is removed from waiting.

3. **Plane leaving the gate**
   LeaveTotal == Leave ∨ LeaveErr
   Leave records the plane leaving its gate. The assignment for plane is removed from the assigned gate.