**Workflow Policy Test Case**

**1. Introduction**

In this test case, we design a scenario where there is a finance asset department in a bank, and the workflow policy is designed for purchasing orders. In the process, FA\_Junior must create the order first, then FA\_Senior can review the order, and finally the FA\_GM can make decision to approve it.

**2. Basic Test Case**

**Subject:** FA\_Employee (FA\_Junior, FA\_Senior), FA\_Manager (FA\_GM)

**Resource:** PurchaseOrder (PurchaseOrder\_One)

**Action:** Create, Review, Approve

**Policy:**

**EmployeePolicy**

(Process\_State 1, FA\_Junior, Create, PurchaseOrder\_One) ->Permit

(Process\_State 2, FA\_Senior, Review, PurchaseOrder\_One) ->Permit

**ManagerPolicy**

(Process\_State 3, FA\_GM, Approve, PurchaseOrder\_One) ->Permit

**3. Test case with Error Type #1 <access conflict>**

**Subject:** FA\_Employee (FA\_Junior, FA\_Senior), FA\_Manager (FA\_GM)

**Resource:** PurchaseOrder (PurchaseOrder\_One)

**Action:** Create, Review, Approve

**Policy:**

**EmployeePolicy**

(Process\_State 1, FA\_Junior, Create, PurchaseOrder\_One) ->Permit

(Process\_State 2, FA\_Senior, Review, PurchaseOrder\_One) ->Permit

**ManagerPolicy**

(Process\_State 3, FA\_GM, Approve, PurchaseOrder\_One) ->Permit

(Process\_State 2, FA\_GM, Review, PurchaseOrder\_One) ->Permit (we add this rule to generate type#1 error, which conflict with that only FA\_Senior can reivew PurchaseOrder\_One in State 2)

**Property (used to check the error):**

(Process\_State = 2) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_One) & (Action = Review) -> decision = Permit

**Result on ACPT: (NuSMV Verification for Merged Policies)**

(Process\_State = 2) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_One) & (Action = Review) -> decision = Permit **in EmployeePolicy is False**

(Process\_State = 2) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_One) & (Action = Review) -> decision = Permit **in ManagerPolicy is True**

**4. Test case with Error Type #2 <no object>**

**Subject:** FA\_Employee (FA\_Junior, FA\_Senior), FA\_Manager (FA\_GM)

**Resource:** PurchaseOrder (PurchaseOrder\_One, PurchaseOrder\_Two (we add this item into resource without assigning any access for subjects))

**Action:** Create, Review, Approve

**Policy:**

**EmployeePolicy**

(Process\_State 1, FA\_Junior, Create, PurchaseOrder\_One) ->Permit

(Process\_State 2, FA\_Senior, Review, PurchaseOrder\_One) ->Permit

**ManagerPolicy**

(Process\_State 3, FA\_GM, Approve, PurchaseOrder\_One) ->Permit

**Property (used to check the error):**

(Process\_State = 1) & (FA\_Employee = FA\_Junior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit

(Process\_State = 2) & (FA\_Employee = FA\_Senior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit

Process\_State = 3) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit

**Result on ACPT:**

(Process\_State = 1) & (FA\_Employee = FA\_Junior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit **is False**

(Process\_State = 2) & (FA\_Employee = FA\_Senior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit **is False**

Process\_State = 3) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit **is False**

**5. Test case with Error Type #3 <undecided>**

**Subject:** FA\_Employee (FA\_Junior, FA\_Senior), FA\_Manager (FA\_GM)

**Resource:** PurchaseOrder (PurchaseOrder\_One, PurchaseOrder\_Two (we add this item into resource with only assigning access for FA\_GM))

**Action:** Create, Review, Approve

**Policy:**

**EmployeePolicy**

(Process\_State 1, FA\_Junior, Create, PurchaseOrder\_One) ->Permit

(Process\_State 2, FA\_Senior, Review, PurchaseOrder\_One) ->Permit

**ManagerPolicy**

(Process\_State 3, FA\_GM, Approve, PurchaseOrder\_One) ->Permit

(Process\_State 3, FA\_GM, Approve, PurchaseOrder\_Two) ->Permit (we only assign access for FA\_GM to PurchaseOrder\_Two)

**Property (used to check the error):**

(Process\_State = 1) & (FA\_Employee = FA\_Junior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit

(Process\_State = 2) & (FA\_Employee = FA\_Senior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit

Process\_State = 3) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit

**Result on ACPT:**

(Process\_State = 1) & (FA\_Employee = FA\_Junior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit **is False**

(Process\_State = 2) & (FA\_Employee = FA\_Senior) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit **is False**

Process\_State = 3) & (FA\_GM = FA\_Manager) & (PurchaseOrder = PurchaseOrder\_Two) & (Action = Review) -> decision = Permit **is True**