Class Test Plan and Results

3.1 FileManager Class Test Scenarios

Test ID	Test Scenario	Category	Input	Expected Output	Actual Output	Status	Comments
FM-01	Load existing valid JSON file	Normal	File with [{"student_id": "S001"}]	Returns list with 1 student	Returns list with 1 student	Pass	Basic file reading functionality
FM-02	Load empty JSON file	Edge	File contains []	Returns empty list []	Returns empty list []	Pass	Handles empty data gracefully
FM-03	Create missing file on initialization	Edge	File doesn't exist	File created with [] content	Dedicated Json files are already built in	Pass	Auto-creation feature
FM-04	Handle corrupted JSON file	Invalid	File contains {invalid json}	Raises FileCorruption Error	Raises FileCorruption Error	Pass	Error handling for bad data

3.2 RoleConfig Class Test Scenarios

Test ID	Test Scenario	Category	Input	Expected Output	Actual Output	Status	Comments
RC-01	Initialize with valid domains	Normal	student_domains=("alustudent.com",)	Domains stored correctly	Domains stored correctly	Pass	Basic configuration setup
RC-02	Handle multiple domains per role	Edge	student_domains=("a.com", "b.com")	Both domains accepted	Both domains accepted	Pass	Supports multiple domain mappings

RC-03	Initialize with empty domain tuple	Edge	student_domains=()	Empty tuple accepted	Empty tuple accepted	Pass	Tests flexibility with no domains
RC-04	Work with default domains	Normal	No parameters provided	Default domains set	Default domains set	Pass	Default configuration behavior
RC-05	Store custom staff domains	Normal	staff_domains=("alu education.com",)	Staff domains stored correctly	Staff domains stored correctly	Pass	Staff-specific configuration

3.3 SystemManager Class Test Scenarios

Role Detection

Test ID	Test Scenario	Category	Input	Expected Output	Actual Output	Status	Comments
SM-01	Determine student role from valid email	Normal	"alice@alustudent.com"	Returns "student"	Returns "student"	Pass	Core role detection logic
SM-02	Determine staff role from valid email	Normal	"john@alueducation.com"	Returns "staff"	Returns "staff"	Pass	Staff role identification
SM-03	Handle email with mixed case	Edge	"Alice@ALUSTUDENT.com"	Returns "student" (case-insensitive)	Returns "student" (case-insensitive)	Pass	Case-insensitive matching
SM-04	Reject email without @ symbol	Invalid	"alicealustudent.com"	Raises ValidationError	Raises ValidationError	Pass	Input validation for email format

Test ID	Test Scenario	Category	Input	Expected Output	Actual Output	Status	Comments
SM-05	Reject unrecognized email domain	Invalid	"alice@gmail.com"	Raises ValidationError	Raises ValidationError	Pass	Domain whitelist enforcement

Resource Management

Test ID	Test Scenario	Category	Input	Expected Output	Actual Output	Status	Comments
SM-06	Add valid resource	Normal	"L001", "Laptop", "IT", 5	Resource added successfully	Resource added successfully	Pass	Basic resource creation
SM-07	Prevent duplicate resource ID	Invalid	Add "L001" twice	Raises ConflictError on second add	Raises ConflictError on second add	Pass	Duplicate prevention
SM-08	Update resource quantity	Normal	"L001", new quantity 10	Quantity updated to 10	Quantity updated to 10	Pass	Quantity modification
SM-09	Remove resource not currently borrowed	Normal	"L001" with no active borrowings	Resource removed successfully	Resource removed successfully	Pass	Safe deletion
SM-10	Prevent removing borrowed resource	Invalid	"L001" currently borrowed	Raises ConflictError	Raises ConflictError	Pass	Protects borrowed items

Borrowing Method

Test ID	Test Scenario	Category	Input	Expected Output	Actual Output	Status	Comments
SM-11	Borrow available resource	Normal	Student "S001", Resource "L001" (qty=5)	Transaction created, qty becomes 4	Transaction created, qty becomes 4	Pass	Core borrowing workflow
SM-12	Calculate due date correctly	Normal	Borrow on "2025-01-01"	Due date is "2025-01-04" (3 days)	Due date is "2025-01-04" (3 days)	Pass	Date calculation logic

SM -13	Prevent borrowing unavailable resource	Invalid	Resource with qty=0	Raises ConflictError	Raises ConflictError	Pass	Availability validation
SM -14	Prevent double borrowing same resource	Invalid	Student borrows L001 twice	Raises ConflictError on second attempt	Raises ConflictError on second attempt	Pass	Duplicate borrowing prevention

Return Method

Tes t ID	Test Scenari o	Categor y	Input	Expected Output	Actual Output	Statu s	Comment s
SM -15	Return borrowe d resource	Normal	Valid transactio n ID	Status="returned ", qty increased by 1	Status="returned ", qty increased by 1	Pass	Core return workflow
SM -16	Prevent returnin g already returned item	Invalid	Transactio n already returned	Raises ConflictError	Raises ConflictError	Pass	Double-re turn preventio n
SM -17	Return by student + resource ID	Normal	Student "S001", Resource "L001"	Finds active transaction, returns it	Finds active transaction, returns it	Pass	Alternativ e return method

3.4 staff_menu Function Test Scenarios

Tes t ID	Test Scenario	Categor y	Input/Actio n	Expected Output	Actual Output	Statu s	Comments
ST- 01	Display menu options correctly	Normal	Staff logs in	Shows 6 menu options (add, update, remove, view, etc.)	Shows 6 menu options (add, update, remove, view, etc.)	Pass	UI presentation

ST-02	Add resource through menu	Normal	Choose option 1, enter valid data	Resource added, confirmation shown	Resource added, confirmation shown	Pass	Complete add workflow
ST-03	Update resource quantity	Normal	Choose option 2, enter resource ID and new qty	Quantity updated successfully	Quantity updated successfully	Pass	Update workflow
ST-04	View all resources in table format	Normal	Choose option 4	Resources displayed in tabulated format	Resources displayed in tabulated format	Pass	Display formatting
ST-05	View overdue transactions	Normal	Choose option 6	Overdue items displayed (if any)	Overdue items displayed (if any)	Pass	Reporting functionality
ST-06	Handle invalid menu choice	Invalid	Enter option 99	Shows "Invalid choice" message	Shows "Invalid choice" message	Pass	Input validation
ST-07	Gracefully handle errors	Edge	Try to remove non-existent resource	Shows error message, returns to menu	Shows error message, returns to menu	Pass	Error recovery

3.5 student_menu Function Test Scenarios

Test ID	Test Scenario	Category	Input/Action	Expected Output	Actual Output	Status	Comments
SU-01	New student registration	Normal	First-time email, provide name	Account created with student ID	Account created with student ID	Pass	First-time user flow
SU-02	Returning student login	Normal	Existing email	Recognizes student, shows "Welcome back"	Recognizes student, shows "Welcome back"	Pass	Existing user recognition

SU-03	View available resources	Normal	Choose option 1	Shows resources with qty > 0 in table	Shows resources with qty > 0 in table	Pass	Resource browsing
SU-04	Borrow available resource	Normal	Choose option 2, enter "L001"	Borrowing succeeds, transaction created	Borrowing succeeds, transaction created	Pass	Complete borrow workflow
SU-05	Return borrowed resource	Normal	Choose option 3, select resource	Return succeeds, qty restored	Return succeeds, qty restored	Pass	Complete return workflow
SU-06	View borrowing history	Normal	Choose option 4	Shows active and past transactions	Shows active and past transactions	Pass	History display
SU-07	Handle borrowing unavailable resource	Invalid	Try to borrow resource with qty=0	Shows error, no transaction created	Shows error, no transaction created	Pass	Availability check
SU-08	Prevent returning non-borrowed item	Invalid	Try to return resource not borrowed	Shows "No active transaction" error	Shows "No active transaction" error	Pass	Return validation