**The UML Diagrams – Solution**

**The Patron**

From the assignment description: A patron has an **id**, a **full name**, a list of **library resources**, and a record of **late fees**. A patron can **borrow resources**, and **return resources**. When a patron borrows a library resource, the check-out date should be the date the item was borrowed. When a patron returns a library resource, the check-in date should be the date the item was returned. A **report** will be generated for all resources borrowed. A **report** will be generated for all fees due. Patrons can borrow up to 5 resources at a time. For simplicity, assume patrons borrow all resources at once and return all resources at once.

Identify the nouns. These will be your variables:

**patronID,**

**fullName,**

**lateFees,**

**list of resources** (a vector limited to 5 elements).

You may also need a variable to keep track of the number of resources:

**numResources**.

Identify the verbs. These will be your functions:

**BorrowResources,**

**ReturnResources,**

**ReportResources,**

**ReportFees.**

|  |
| --- |
| Patron |
| -patronID: int  -fullName: string  -numResources: int  -lateFees: double |
| <<constructor>>Patron(id: int, name: string)  +BorrowResources(void)  +ReturnResources(void)  +ReportResources(void)  +ReportFees(void) |

**The Library Resource**

From the assignment description: A library resource has a **title**, a **catalog ID**, **check-out date**, and **check-in date**. When a resource is borrowed, the **check-out** **date is recorded**. When a resource is returned, the **check-in** **date is recorded**. When all resources are returned, **fees are calculated**.

Identify the nouns. These will be your variables:

**title,**

**catalogID,**

**checkOutDate,**

**checkInDate**.

Identify the verbs. These will be your functions:

**CheckOut,**

**CheckIn,**

**CalculateFees**.

You may also need helper functions to get the title and catalog ID:

**GetTitle,**

**GetCatalogID**.

|  |
| --- |
| LibraryResource |
| -title: string  -catalogID: int  #checkOutDate: time\_t  #checkinDate: time\_t |
| <<constructor>>LibraryResource(id: int)  +CheckOut(date: time\_t)  +CheckIn(date: time\_t)  +CalculateFees(void): double  +GetTitle(): string  +GetCatalogID(): int |

From the assignment, note how fees are calculated in the default case for library resources:

* For all other library resources (the default case): Patrons can borrow up to 28 days. Returns after 28 days are late. Late fees are calculated as follows – 10 cents per day to a maximum of $5.00 per resource.

Note: title and catalogID are common to all library resources.

Note: checkOutDate and checkInDate are private but inherited by all children to calculate the fees, therefore are protected.

**The Book**

From the assignment description: A book is a library resource. It has a **title**, **author** name, **year of publication** and it could be either an eBook or a standard paper book. For simplicity, assume only one author. **Fees are calculated** for each book. From the assignment description:

* For a standard book: Patrons can borrow a standard book for up to 21 days. Returns after 21 days are late. Late fees are calculated as follows – 15 cents per day to a maximum of $6.00 per book.
* For an electronic book: Patrons can borrow an electronic book for up to 7 days. Returns after 7 days are late. Late fees are calculated as follows – 30 cents per day to a maximum of $12.00 per electronic book.

Identify the nouns. These will be your variables:

**title** (inherit from Library Resource, common to all resources),

**author,**

**yearOfPublication.**

Identify the verbs. These will be your functions:

**CalculateFees** (this will override the Library Resource function).

|  |
| --- |
| Book |
| -author: string  -yearOfPublication: int |
| <<constructor>>Book(\_title: string,  \_author: string, \_year: int, \_id: int)  +CalculateFees(void): double |

|  |
| --- |
| ElectronicBook |
|  |
| <<constructor>>ElectronicBook  (\_title: string, \_author: string, \_year: int, \_id: int)  +CalculateFees(void): double |

|  |
| --- |
| StandardPaperBook |
|  |
| <<constructor>>StandardPaperBook  (\_title: string, \_author: string, \_year: int, \_id: int)  +CalculateFees(void): double |

**The DVD**

From the assignment description: A DVD is a library resource. It has a **title** and **release year**. **Fees are calculated** when a DVD is returned. From the assignment, fees are calculated as follows:

* For a DVD: Patrons can borrow a DVD for up to 14 days. Returns after 14 days are late. Late fees are calculated as follows – 25 cents per day to a maximum of $9.00 per DVD.

Identify the nouns. These will be your variables:

**title** (inherited from Library resource),

**releaseYear**.

Identify the verbs. These are your functions:

**CalculateFees** (this will override the Library Resource function).

|  |
| --- |
| DVD |
| -releaseYear: int |
| <<constructor>>DVD(\_title: string,  \_year: int, \_id: int)  +CalculateFees(void): double |

**The Musical Instrument**

From the assignment description: A musical instrument is a library resource and has a **name**. **Fees are calculated** when a musical instrument is returned. From the assignment, fees are calculated as follows:

* For a musical instrument: Patrons can borrow a musical instrument for up to 5 days. Returns after 5 days are late. Late fees are calculated as follows – 50 cents per day to a maximum of $15.00 per musical instrument.

Identify the nouns. These will be your variables:

**name** (use **title** inherited from Library resource).

Identify the verbs. These are your functions:

**CalculateFees** (this will override the Library Resource function).

|  |
| --- |
| MusicalInstrument |
|  |
| <<constructor>>MusicalInstrument  (\_name: string, \_id: int)  +CalculateFees(void): double |

**The UML Diagram**

A patron has up to 5 library resources. A library resource can be a book (electronic book or standard paper book), a DVD, or a musical instrument.

|  |
| --- |
| LibraryResource |
| -title: string  -catalogID: int  #checkOutDate: time\_t  #checkinDate: time\_t |
| <<constructor>>LibraryResource(id: int)  +CheckOut(date: time\_t)  +CheckIn(date: time\_t)  +CalculateFees(void): double  +GetTitle(): string  +GetCatalogID(): int |

|  |
| --- |
| Patron |
| -patronID: int  -fullName: string  -numResources: int  -lateFees: double |
| <<constructor>>Patron(id: int, name: string)  +BorrowResources(void)  +ReturnResources(void)  +ReportResources(void)  +ReportFees(void) |

0..5

|  |
| --- |
| MusicalInstrument |
|  |
| <<constructor>>MusicalInstrument  (\_name: string, \_id: int)  +CalculateFees(void): double |

|  |
| --- |
| Book |
| -author: string  -yearOfPublication: int |
| <<constructor>>Book(\_title: string,  \_author: string, \_year: int, \_id: int)  +CalculateFees(void): double |

|  |
| --- |
| DVD |
| -releaseYear: int |
| <<constructor>>DVD(\_title: string,  \_year: int, \_id: int)  +CalculateFees(void): double |

|  |
| --- |
| ElectronicBook |
|  |
| <<constructor>>ElectronicBook  (\_title: string, \_author: string, \_year: int, \_id: int)  +CalculateFees(void): double |

|  |
| --- |
| StandardPaperBook |
|  |
| <<constructor>>StandardPaperBook  (\_title: string, \_author: string, \_year: int, \_id: int)  +CalculateFees(void): double |