



Module 20

Partha Pratim
Das

Objectives &
Outline

Hierarchy
Employee Hierarchy

Leave
Hierarchy

QC

Relationship

Summary

Module 20: Object-Oriented Analysis & Design

Identification of Classes, Objects & Relationships in LMS:

An Exploratory Exercise: Part 4

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Module Objectives

Module 20

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Das

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Hierarchy

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- Perform an exploratory exercise to identify potential classes, objects, and relationships for the Leave Management System (LMS)
- The following will be used as primary source of information for LMS (as received from the client)
 - Written English description of LMS (PDF document as shared)
 - Conversation between client and vendor (Tutorial video as uploaded)
- This will be a multi-module exercise spanning Module 17 to 20

Please keep these handy while you study these modules. We shall frequently refer to those



Module Outline

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Objectives & Outline

Hierarchy

Employee Hierarchy

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QC

Relationship

Summary

- Refinement of Hierarchy
 - Employee Hierarchy
 - Leave Hierarchy
- Relationships



Employee Hierarchy: RECAP (Module 19)

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Objectives &
Outline

Hierarchy
Employee Hierarchy

Leave
Hierarchy

QC

Relationship

Summary

Class: Employee
Attributes: <ul style="list-style-type: none">• Name• ID• DoB
Responsibilities: <ul style="list-style-type: none">• Record Daily Attendance• Request for Leave• Cancel an Approved Leave• Avail Leave, if approved

IS-A

Class: Executive
Attributes: <ul style="list-style-type: none">• Reporting_Lead• ...
Additional Responsibilities: <ul style="list-style-type: none">• Report to Lead

Class: Lead
Attributes: <ul style="list-style-type: none">• Reporting_Manager• List of Reporting Executives
Additional Responsibilities: <ul style="list-style-type: none">• Approve Leave (Executive)• Regret Leave (Executive)• Revoke Leave (Executive)• Report to Manager• Take Reporting (Executive)

Class: Manager
Attributes: <ul style="list-style-type: none">• List of Reporting Leads• ...
Additional Responsibilities: <ul style="list-style-type: none">• Approve Leave (Lead)• Regret Leave (Lead)• Revoke Leave (Lead)• Take Reporting (Lead)

- For brevity, all characteristics and all responsibilities are not shown
- Suggest refinements to Employee hierarchy



Employee Hierarchy: RECAP (Module 19)

Module 20

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Objectives & Outline

Hierarchy

Employee Hierarchy

Leave Hierarchy

QC

Relationship

Summary

Class: Executive

Attributes:

- Reporting_Lead
- ...

Additional Responsibilities:

- Report to Lead

is_a

Class: Lead

Attributes:

- Reporting_Manager
- List of Reporting Executives

Additional Responsibilities:

- Approve Leave (Executive)
- ...

is_a

Class: Manager

Attributes:

- List of Reporting Leads
- ...

Additional Responsibilities:

- Approve Leave (Lead)
- Regret Leave (Lead)
- Revoke Leave (Lead)
- Take Reporting (Lead)



Employee Hierarchy: RECAP (Module 19)

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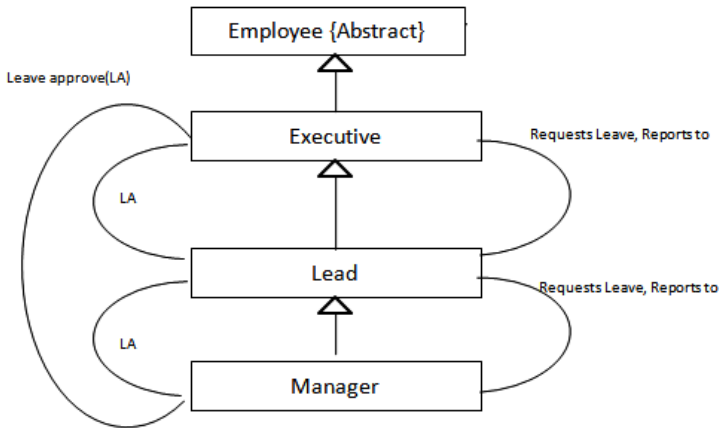
Hierarchy
Employee Hierarchy

Leave Hierarchy

QC

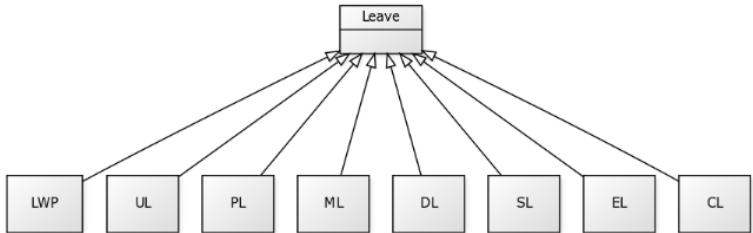
Relationship

Summary





Leave Hierarchy



- **Quality Check**

- Hierarchy is rather Wide and Shallow
- Action: Identify Intangible Concepts to Balance



Leave Hierarchy: Analysis of Pre– and Post– Conditions

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Objectives &
Outline

Hierarchy
Employee Hierarchy

Leave
Hierarchy

QC

Relationship

Summary

Property	CL	EL	SL	DL	ML	PL	LWP	UL
<i>Entitlement</i>	Y	Y	Y	NA	Y ^a	Y	Y	N ^b
<i>Duration of Leave</i>	Y	Y	Y	NA	Y	Y	Y	N ^c
<i>Is Leave Clubbable?</i>	N	Y	Y	NA	Y	Y	Y	N
<i>Is Holiday exempt in Leave?</i>	Y	N	N	NA	N	N	N	N
<i>Must Leave be Pre-Approved?</i>	N	Y	N ^d	NA	Y	N ^e	Y	N
<i>Does Leave Carry-over & Accumulate?</i>	N	Y	Y	NA	N	N	N	N
<i>Can Leave be En-cashed?</i>	N	Y	N	NA	N	N	N	N
<i>Does Leave need Certification?</i>	N	N	Y	NA	Y	Y	N	N
<i>Is Leave paid?</i>	Y	Y	Y	NA	Y	Y	N	N

^a: Only for female, when pregnant, twice in career

^b: Deemed entitlement for a week before actions start

^c: Allowed for up to a 7 days

^d: Exception condition for sickness

^e: Exception condition for parenthood



Leave Hierarchy

Module 20

Partha Pratim Das

Objectives & Outline

Hierarchy

Employee Hierarchy

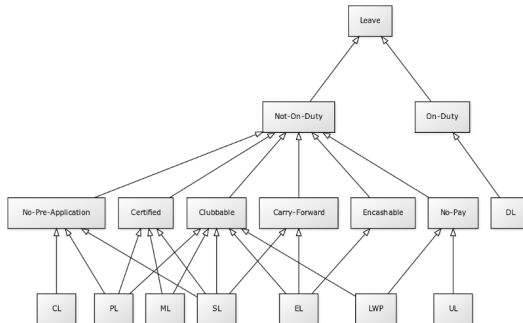
Leave Hierarchy

QC

Relationship

Summary

Property	CL	EL	SL	DL	ML	PL	LWP	UL
Entitlement	Y	Y	Y	NA	Y ^a	Y	Y	N ^b
Duration of Leave	Y	Y	Y	NA	Y	Y	Y	N ^c
Is Leave Clubbable?	N	Y	Y	NA	Y	Y	Y	N
Is Holiday exempt in Leave?	Y	N	N	NA	N	N	N	N
Must Leave be Pre-Approved?	N	Y	N ^d	NA	Y	N ^e	Y	N
Does Leave Carry-over & Accumulate?	N	Y	Y	NA	N	N	N	N
Can Leave be En-cashed?	N	Y	N	NA	N	N	N	N
Does Leave need Certification?	N	N	Y	NA	Y	Y	N	N
Is Leave paid?	Y	Y	Y	NA	Y	Y	N	N





Leave Hierarchy

Module 20

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Objectives & Outline

Hierarchy

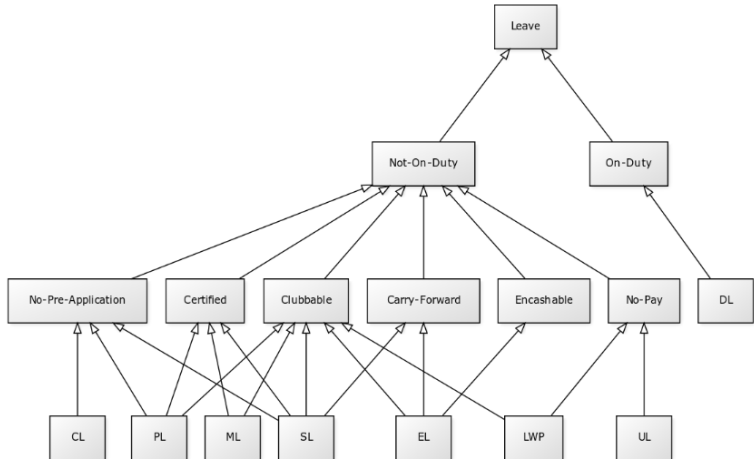
Employee Hierarchy

Leave Hierarchy

QC

Relationship

Summary



- **Quality Check**
 - **Balanced Hierarchy**



Quality Measure

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Objectives &
Outline

Hierarchy

Employee Hierarchy

Leave
Hierarchy

QC

Relationship

Summary

Module	Impact On				
	Coupling	Cohesion	Sufficiency	Completeness	Primitiveness
Company	Low	High	Low	Low	Low
Employee	Moderate	High	Low	Moderate	Moderate
Leave	Moderate	High	Low	Moderate	Moderate



Relationship among Classes

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Objectives & Outline

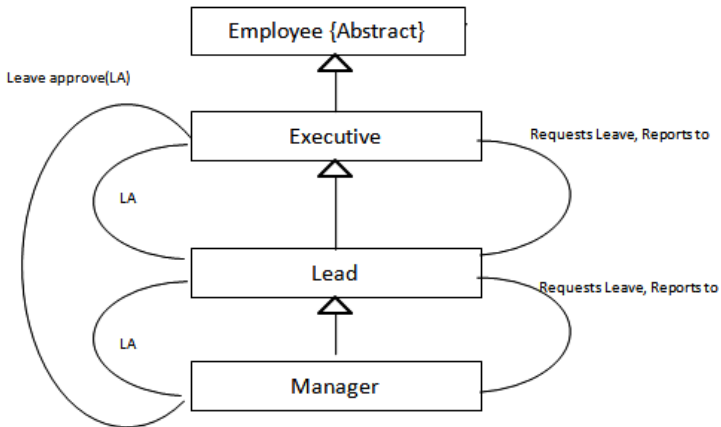
Hierarchy
Employee Hierarchy

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QC

Relationship

Summary





Relationships by Use-Cases

Wrong UML

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Objectives & Outline

Hierarchy

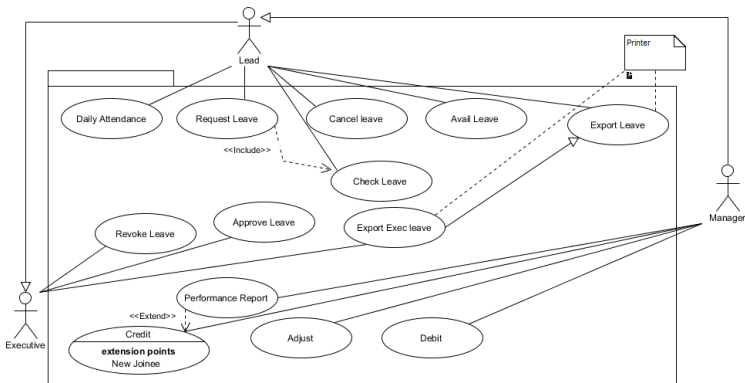
Employee Hierarchy

Leave Hierarchy

QC

Relationship

Summary



Employees and Leave Actions are Related



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Objectives & Outline

Hierarchy

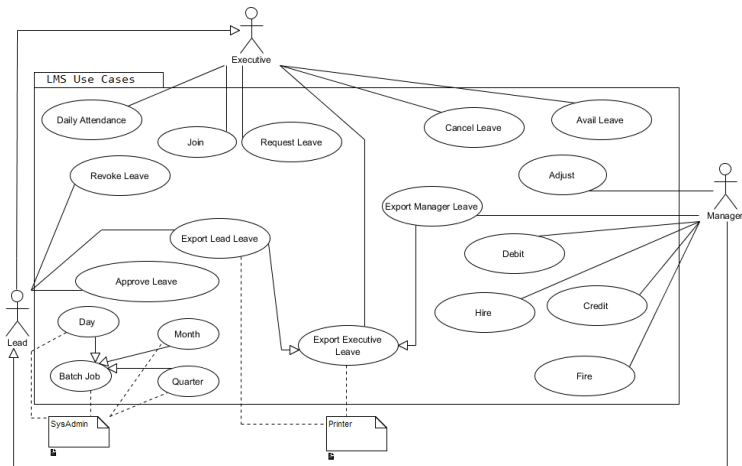
Employee Hierarchy

Leave Hierarchy

QC

Relationship

Summary



Base Use-Case Diagram



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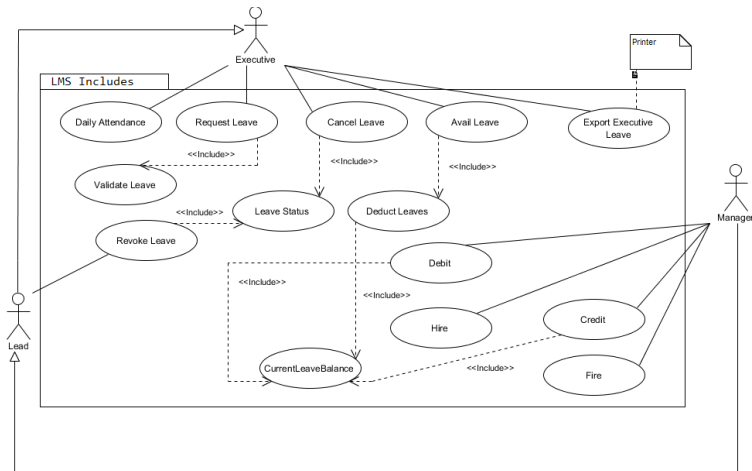
Hierarchy
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Leave
Hierarchy

QC

Relationship

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Includes Relationship



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Objectives & Outline

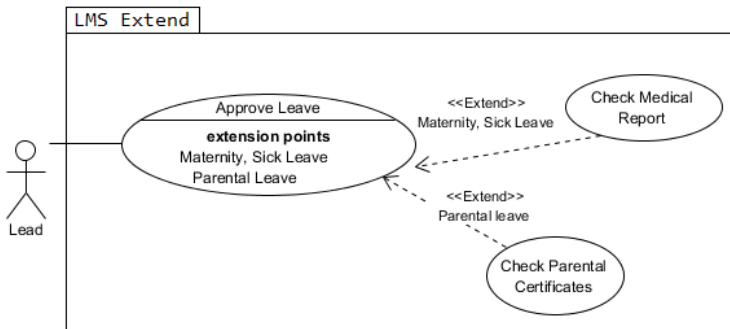
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Extends Relationship



Module Summary

Module 20

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Das

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Outline

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Hierarchy

QC

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Summary

- Understood the refinement of hierarchy
- Outlined relationships
- Need to have tools for better capture and refinement – UML to be used to refine the design further



Instructor and TAs

Module 20

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Das

Objectives &
Outline

Hierarchy
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Leave
Hierarchy

QC

Relationship

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