Programmering og Problemløsning

14.1: Nedarvning

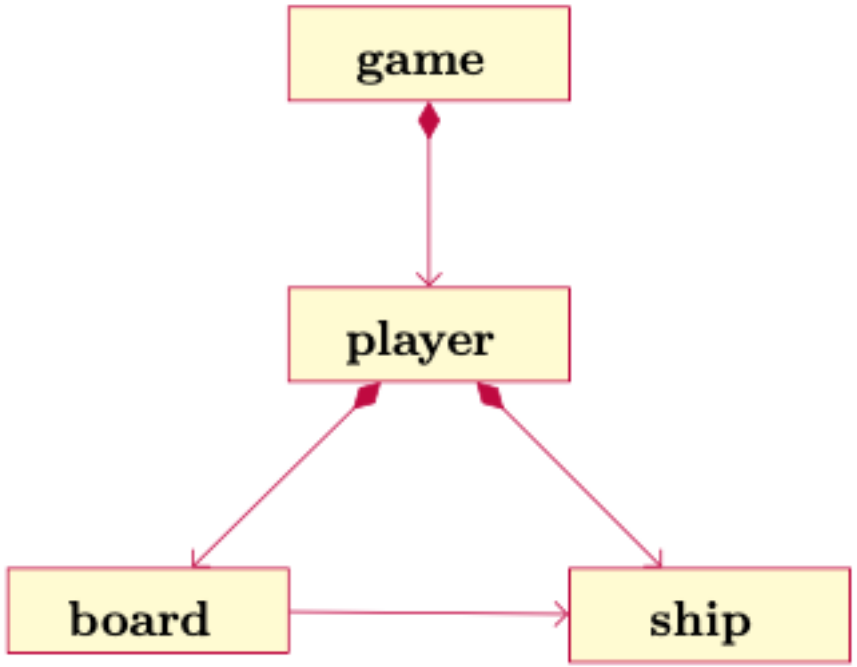
Design efter navne- og udsagnsord

Use-case: Sænke slagskibe

Dette er et spil for to personer, der kan spilles med papir og blyant. Der spilles på fire plader, to for hver spiller, og hver plade er inddelt i 10x10 felter. Hvert felt identificeres vha. dets række- og søjlenummer.

Hver spiller får tildelt et antal skibe, som placeres på spillerens ene plade og markerer, hvor modstanderen har forsøgt at skyde. På den anden plade markerer spilleren tilsvarende, hvor han/hun har forsøgt at ramme modstanderen.

Når skibene er placeret skiftes spillerne til at skyde på modstanderens felt, og modstanderen annoncerer ramt eller plask, alt efter om et skib blev ramt eller ej. Vinderen er den, der først får sænket alle modstanderes skibe.



`battleship.fsx`

Overload

Navne kan genbruges, blot skal parameter antallet og/eller typer være forskelligt.

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type person (name : string) =
  member this.name = name
  member this.greetings () = name+" says hi"
  member this.greetings (str : string) =
    name+" "+str

let p = person ("Jon")
printfn "%s" (p.greetings ())
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```
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Jon says hi
Jon says goodbye
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Fordele: Metodenavne kan være mere generelle

```
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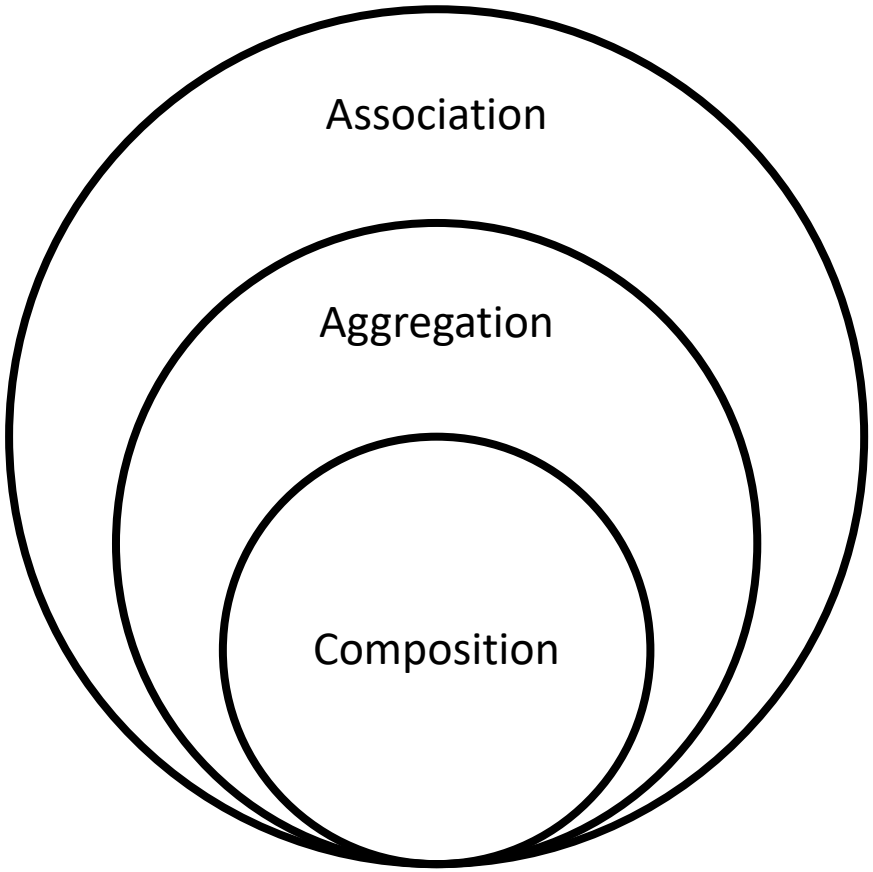
Relationer mellem objekter (has-a)

Composition: En hund har 4 ben



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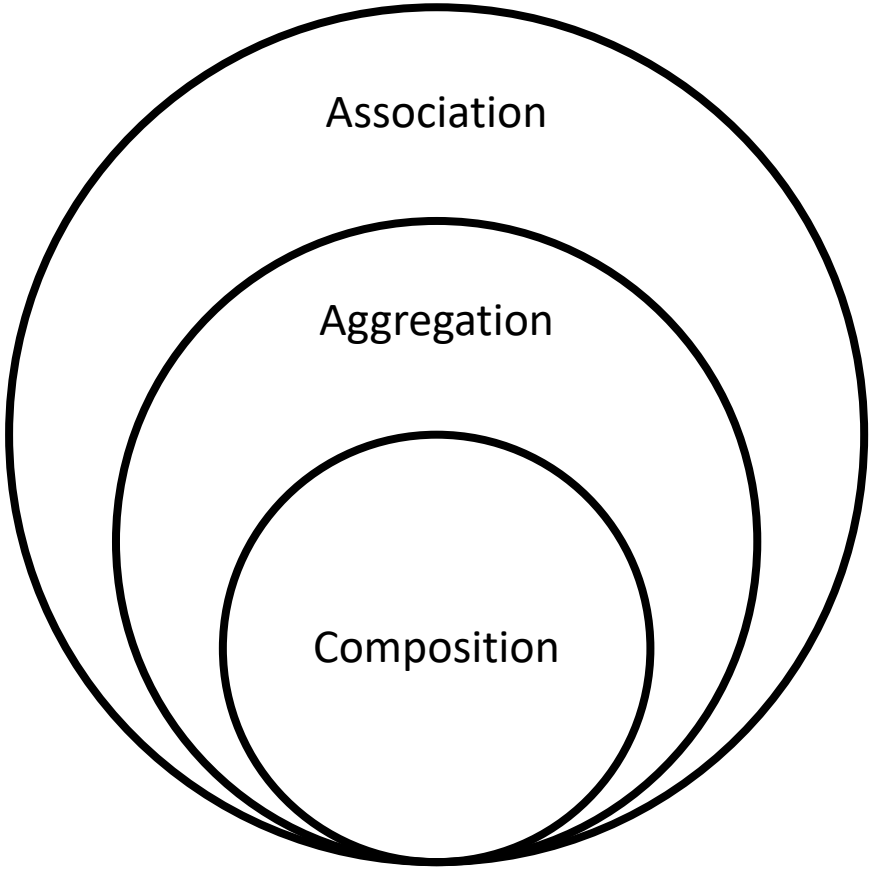

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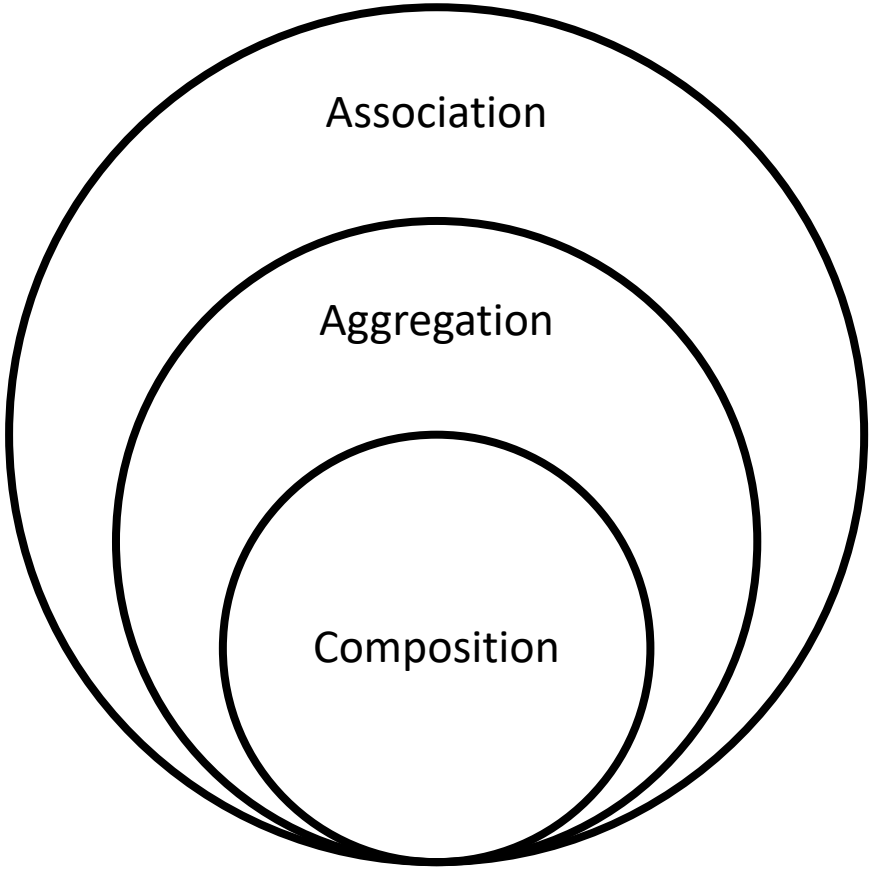
Listing 22.3 umlComposition.fsx:
The dog object is a composition of four leg objects.

```
1  type leg () =
2    member this.move = "moving"
3  type dog () =
4    let _leg = List.init 4 (fun e -> leg ())
5
6  let bestFriend = dog ()
```

Relationer mellem objekter (has-a)



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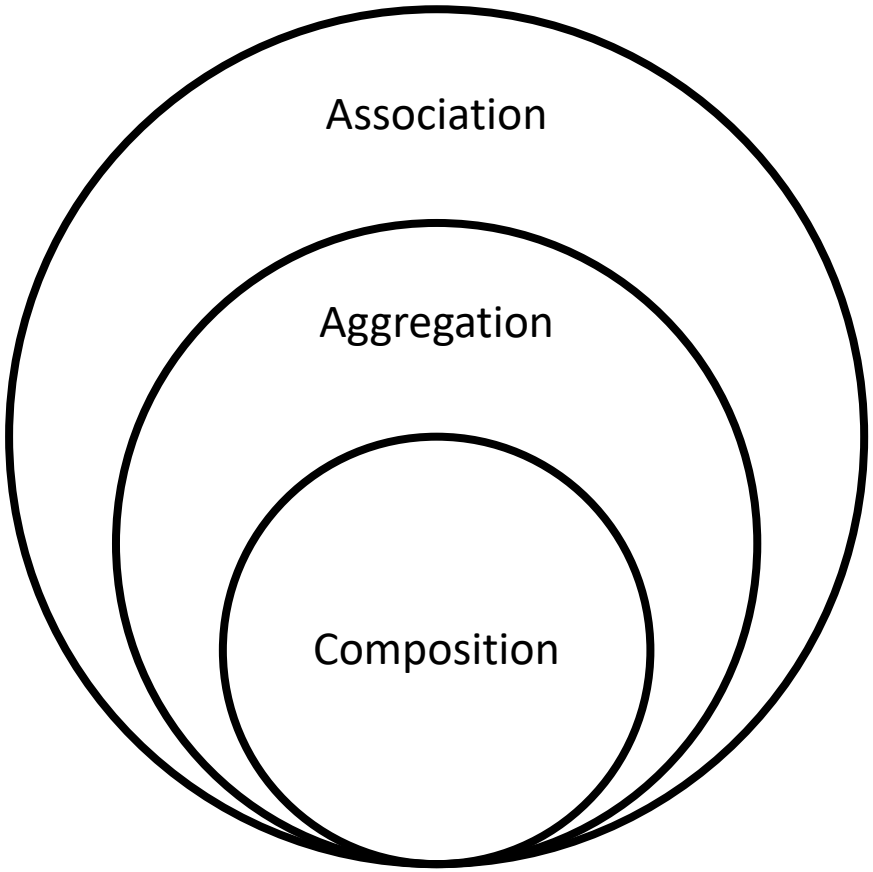

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Aggregation: En forfatter skriver og udgiver en bog, en læser køber bogen

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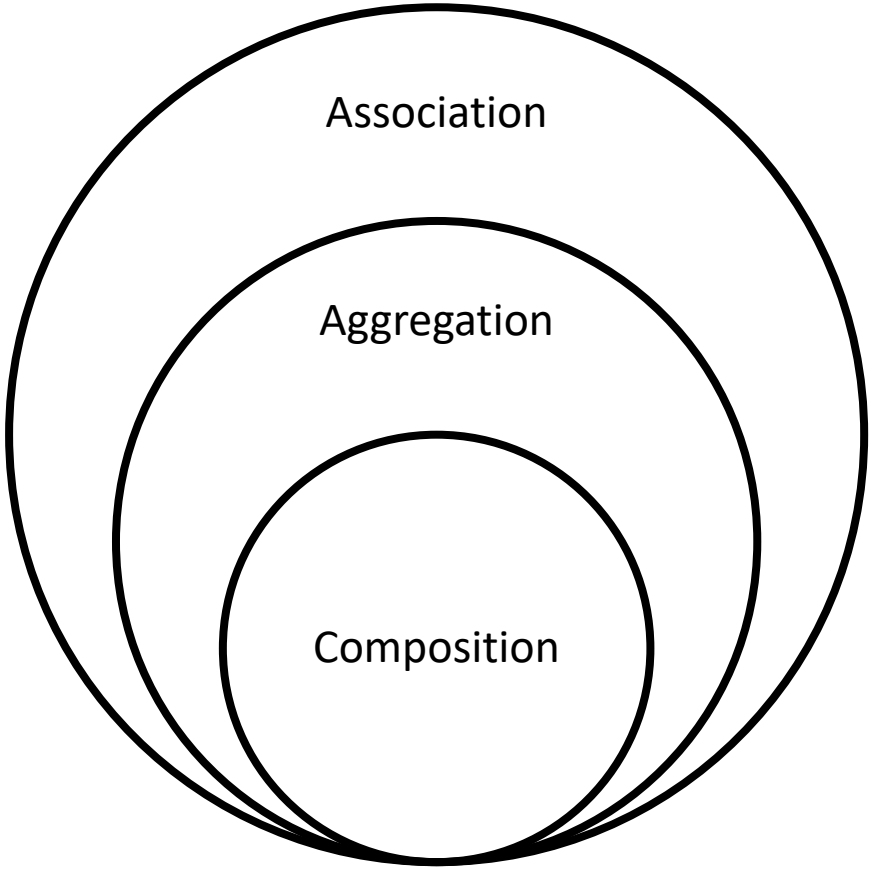

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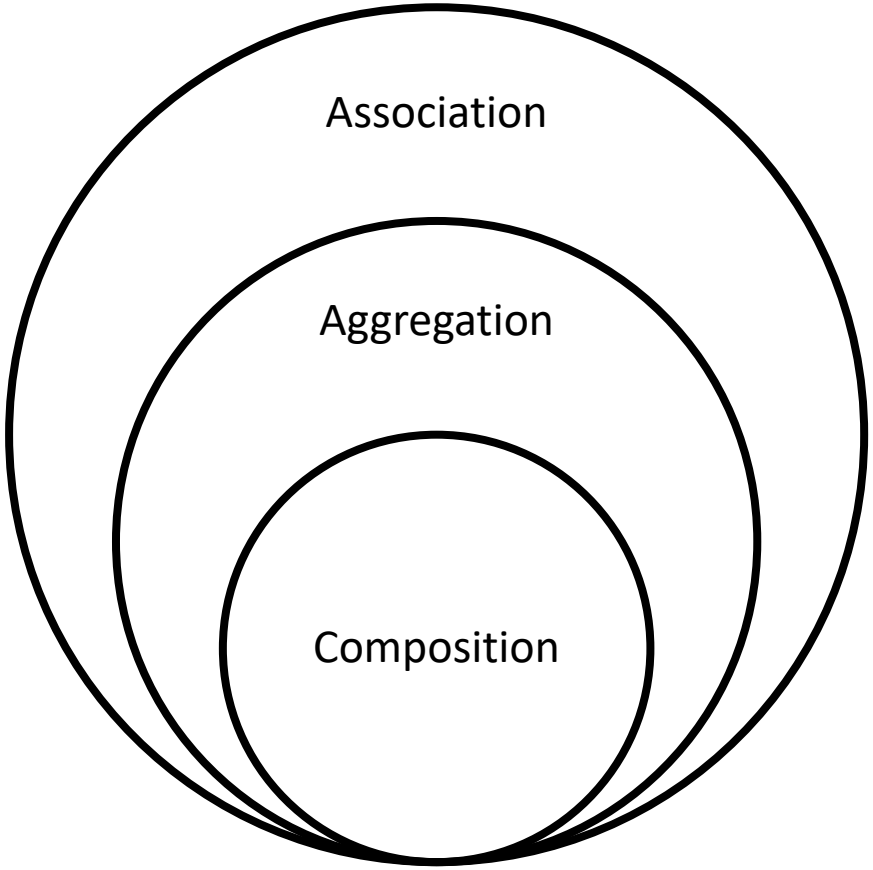
Listing 22.2 umlAggregation.fsx:
The book has an aggregated relation to author and reader.

```
1  type book (name : string) =
2    let mutable _name = name
3  type author () =
4    let _book = book("Learning to program")
5    member this.publish() = _book
6  type reader () =
7    let mutable _book : book option = None
8    member this.buy (b : book) = _book <- Some b
9
10 let a = author ()
11 let r = reader ()
12 let b = a.publish ()
13 r.buy (b)
```

Relationer mellem objekter (has-a)



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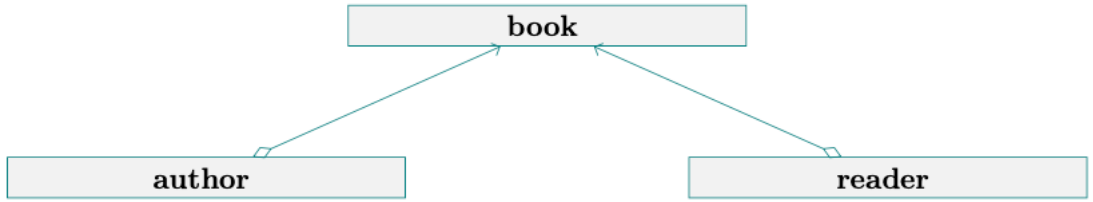

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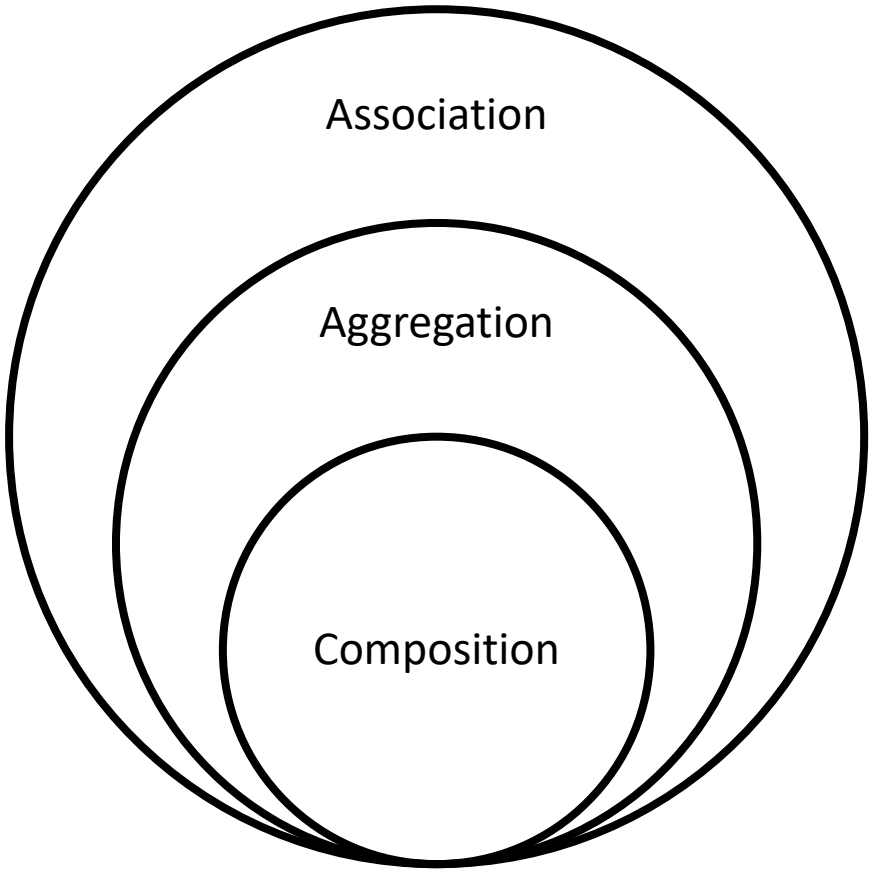

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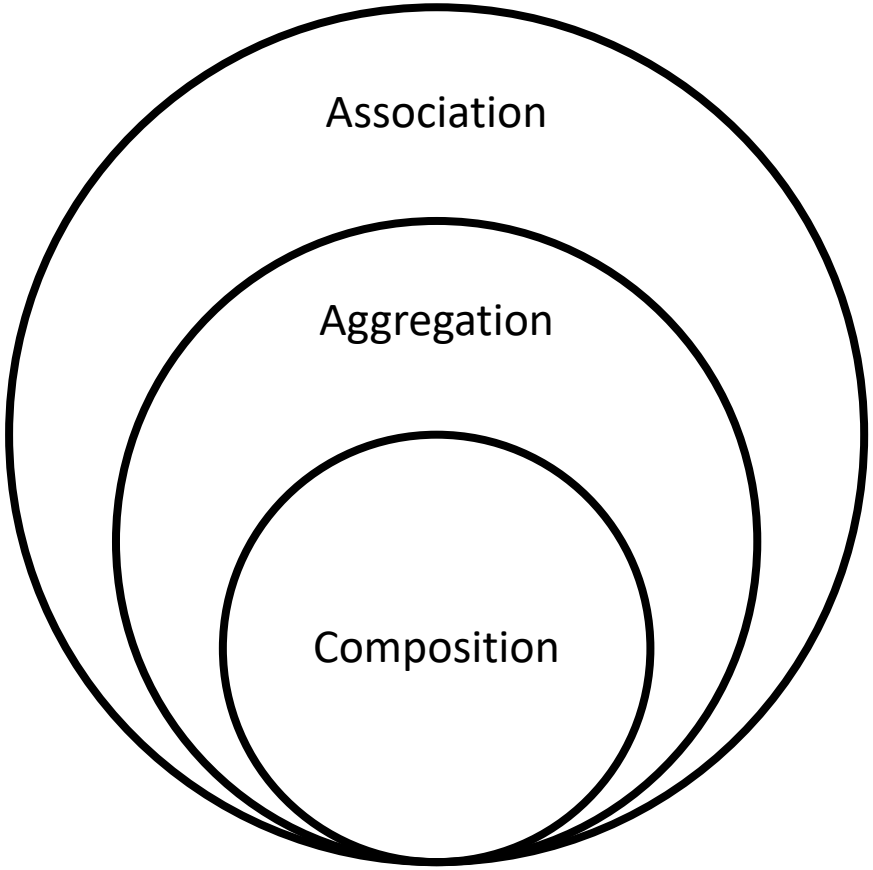

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Listing 22.1 umlAssociation.fsx:
The student is associated with a teacher.

```
1  type teacher () =
2    member this.answer (q : string) = "4"
3  type student (t : teacher) =
4    member this.ask () = t.answer("What is 2+2?")
5
6  let t = teacher ()
7  let s = student (t)
8  s.ask()
```

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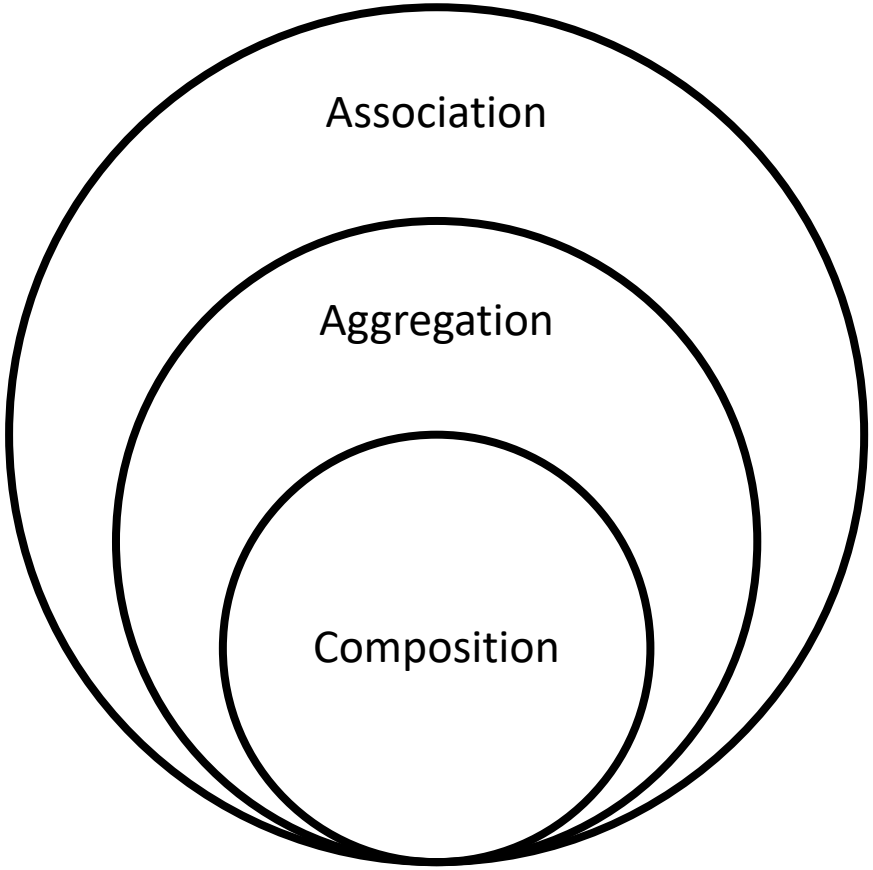

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Nedarvning (is-a)

En studerende og en lærer har begge et navn. En studerende har en bog, og en lærer har et sæt af powerpoint slides.

Listing 22.4 umlInheritance.fsx:
The student and the teacher class inherits from the person class.

```
1  type person (name : string) =
2    member this.name = name
3  type student (name : string, book : string) =
4    inherit person(name)
5    member this.book = book
6  type teacher (name : string, slides : string) =
7    inherit person(name)
8    member this.slides = slides
9
10 let s = student("Hans", "Learning to Program")
11 let t = teacher("Jon", "Slides of the day")
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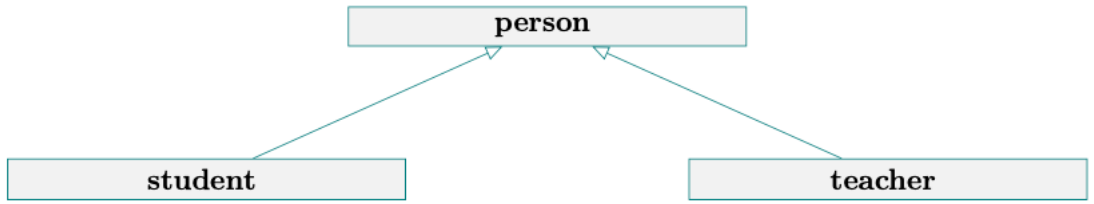

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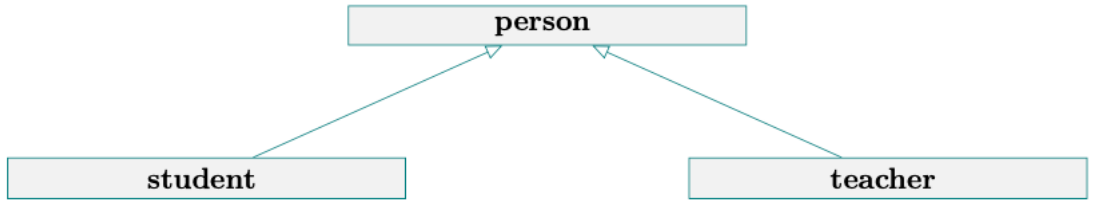

Fordele: Kodegenbrug, semantisk hierarki
Bagdele: Risiko for spaghettikode

Overshadow, upcasting og downcasting

Genbrug af navne i underklasser overskygger baseklassens navne. Downcasting og upcasting navigerer hiearkiet.

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type person (name : string) =
  member this.name = name
  member this.introduction = "I'm " + name
type teacher (name : string) =
  inherit person(name)
  member this.introduction = "I'm Prof. " + name

let p = person ("Hans")
printfn "%s" p.introduction
let t = teacher ("Jon")
printfn "%s" t.introduction
let tp = t :> person
printfn "%s" tp.introduction
let tpt = tp :?> teacher
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```
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I'm Hans
I'm Prof. Jon
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I'm Hans
I'm Prof. Jon
I'm Jon
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```

Fordele: ‘reparation’, hierarkiske definitioner, underklasser i samme liste
Bagdele: downcasting kan give run-time fejl

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[<AbstractClass>]
type person (name : string) =
  member this.name = name
  abstract member introduction : string
type teacher (name : string) =
  inherit person(name)
  override this.introduction = "I'm Prof. " + name

let t = teacher ("Jon")
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let tp = t :> person
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```
sporring@Jons-mac src % fsharpi override.fsx
I'm Prof. Jon
I'm Prof. Jon
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Fordele: kan stille krav til underklasser
Bagdele: baseklassen kan ikke instantieres

```
sporring@Jons-mac src % fsharpi override.fsx
I'm Prof. Jon
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Interface (is-a)

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The `television` and the `car` class both implement the `button` interface.

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1  type button =
2    abstract member press : unit -> string
3  type television () =
4    interface button with
5      member this.press () = "Changing channel"
6  type car () =
7    interface button with
8      member this.press () = "Activating wipers"
9  let pressIt (elm : #button) =
10   elm.press()
11
12 let t = television()
13 let c = car()
14 printfn "%s" (pressIt t)
15 printfn "%s" (pressIt c)
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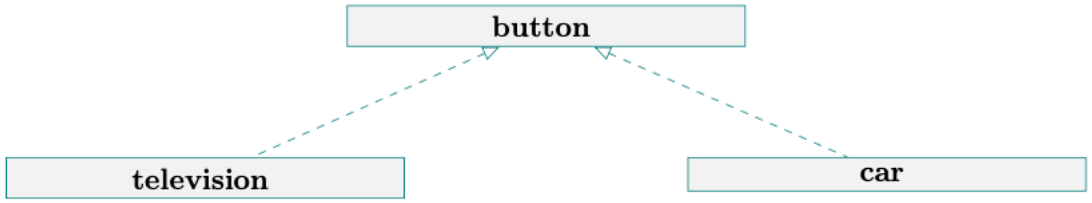

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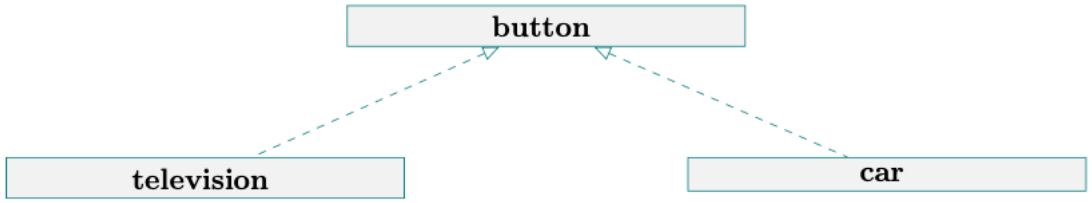

Fordele: Angiver egenskaber, semantisk graf
Bagdele: Risiko for megen up- og downcasting

Opsummering

- Med overloading kan vi genbruge navne til små variationer i inputparametre
- Association: “kender-til” - besked relation
- Aggregation: “har-en/flere” – udveksling af ejeskab
- Composition: “har-en/flere” – een ejer
- Overshadow: Navnesammenfald i nedarvning skygger i underklassen
- Abstrakte klasser og override: Abstrakte klasser kan kræve nedarvning og metodedefinitioner.
- Interfaces: Interfaces giver klasser egenskaber, som kan bruges på tværs af det semantiske design.