

## How Julia programs are organized

In [1]: *# Functions - All Julia functions are generic*

```
function f(x,y)
    x + y
end
```

Out[1]: f (generic function with 1 method)

In [2]: *# Fast user defined datatypes*

```
immutable Point{T}
    x::T
    y::T
end

p = Point(1,2)
```

Out[2]: Point{Int64}(1,2)

```
In [3]: # Methods - Particular specialization of a function. Picked through multiple dispatch.  
methods(+)
```

Out[3]: 171 methods for generic function +:

- `+(x::Bool)` at `bool.jl:33`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/bool.jl#L33>)
- `+(x::Bool, y::Bool)` at `bool.jl:36`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/bool.jl#L36>)
- `+(y::AbstractFloat, x::Bool)` at `bool.jl:46`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/bool.jl#L46>)
- `+(x::Int64, y::Int64)` at `int.jl:8`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L8>)
- `+(x::Int8, y::Int8)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::UInt8, y::UInt8)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::Int16, y::Int16)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::UInt16, y::UInt16)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::Int32, y::Int32)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::UInt32, y::UInt32)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::UInt64, y::UInt64)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::Int128, y::Int128)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::UInt128, y::UInt128)` at `int.jl:16`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/int.jl#L16>)
- `+(x::Integer, y::Ptr{T})` at `pointer.jl:77`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pointer.jl#L77>)
- `+(x::Float32, y::Float32)` at `float.jl:207`  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/float.jl#L207>)
- `+(x::Float64, y::Float64)` at `float.jl:208`

- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/float.jl#L208>
- **+ (z::Complex{T<:Real}, w::Complex{T<:Real})** at [complex.jl:111](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L111)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L111>
- **+ (x::Bool, z::Complex{Bool})** at [complex.jl:118](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L118)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L118>
- **+ (z::Complex{Bool}, x::Bool)** at [complex.jl:119](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L119)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L119>
- **+ (x::Bool, z::Complex{T<:Real})** at [complex.jl:125](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L125)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L125>
- **+ (z::Complex{T<:Real}, x::Bool)** at [complex.jl:126](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L126)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L126>
- **+ (x::Real, z::Complex{Bool})** at [complex.jl:132](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L132)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L132>
- **+ (z::Complex{Bool}, x::Real)** at [complex.jl:133](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L133)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L133>
- **+ (x::Real, z::Complex{T<:Real})** at [complex.jl:144](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L144)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L144>
- **+ (z::Complex{T<:Real}, x::Real)** at [complex.jl:145](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L145)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/complex.jl#L145>
- **+ (x::Rational{T<:Integer}, y::Rational{T<:Integer})** at [rational.jl:179](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/rational.jl#L179)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/rational.jl#L179>
- **+ (x::Bool, A::AbstractArray{Bool,N})** at [arraymath.jl:136](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L136)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L136>
- **+ (x::Integer, y::Char)** at [char.jl:43](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/char.jl#L43)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/char.jl#L43>
- **+ (a::Float16, b::Float16)** at [float16.jl:136](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/float16.jl#L136)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/float16.jl#L136>
- **+ (x::BigInt, y::BigInt)** at [gmp.jl:256](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L256)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L256>
- **+ (a::BigInt, b::BigInt, c::BigInt)** at [gmp.jl:279](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L279)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L279>
- **+ (a::BigInt, b::BigInt, c::BigInt, d::BigInt)** at [gmp.jl:285](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L285)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L285>
- **+ (a::BigInt, b::BigInt, c::BigInt, d::BigInt, e::BigInt)** at [gmp.jl:292](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L292)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L292>
- **+ (x::BigInt, c::Union{UInt16, UInt32, UInt64, UInt8})** at [gmp.jl:304](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L304)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L304>

- `+(c::Union{UInt16,UInt32,UInt64,UInt8}, x::BigInt)` at [gmp.jl:308](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L308)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L308>)
- `+(x::BigInt, c::Union{Int16,Int32,Int64,Int8})` at [gmp.jl:320](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L320)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L320>)
- `+(c::Union{Int16,Int32,Int64,Int8}, x::BigInt)` at [gmp.jl:321](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L321)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/gmp.jl#L321>)
- `+(x::BigFloat, y::BigFloat)` at [mpfr.jl:208](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L208)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L208>)
- `+(x::BigFloat, c::Union{UInt16,UInt32,UInt64,UInt8})` at [mpfr.jl:215](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L215)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L215>)
- `+(c::Union{UInt16,UInt32,UInt64,UInt8}, x::BigFloat)` at [mpfr.jl:219](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L219)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L219>)
- `+(x::BigFloat, c::Union{Int16,Int32,Int64,Int8})` at [mpfr.jl:223](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L223)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L223>)
- `+(c::Union{Int16,Int32,Int64,Int8}, x::BigFloat)` at [mpfr.jl:227](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L227)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L227>)
- `+(x::BigFloat, c::Union{Float16,Float32,Float64})` at [mpfr.jl:231](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L231)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L231>)
- `+(c::Union{Float16,Float32,Float64}, x::BigFloat)` at [mpfr.jl:235](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L235)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L235>)
- `+(x::BigFloat, c::BigInt)` at [mpfr.jl:239](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L239)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L239>)
- `+(c::BigInt, x::BigFloat)` at [mpfr.jl:243](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L243)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L243>)
- `+(a::BigFloat, b::BigFloat, c::BigFloat)` at [mpfr.jl:379](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L379)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L379>)
- `+(a::BigFloat, b::BigFloat, c::BigFloat, d::BigFloat)` at [mpfr.jl:385](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L385)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L385>)
- `+(a::BigFloat, b::BigFloat, c::BigFloat, d::BigFloat, e::BigFloat)` at [mpfr.jl:392](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L392)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/mpfr.jl#L392>)
- `+(x::Irrational{sym}, y::Irrational{sym})` at [irrationals.jl:72](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/irrationals.jl#L72)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/irrationals.jl#L72>)
- `+(x::Number)` at [operators.jl:73](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L73)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L73>)
- `+{T<Number}(x::T<Number, y::T<Number)` at [promotion.jl:211](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/promotion.jl#L211)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/promotion.jl#L211>)
- `+{T<AbstractFloat}(x::Bool, y::T<AbstractFloat)` at [bool.jl:43](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/bool.jl#L43)

- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/bool.jl#L43>
- `+(x::Number, y::Number)` at [promotion.jl:167](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/promotion.jl#L167)
- `+(r1::OrdinalRange{T,S}, r2::OrdinalRange{T,S})` at [operators.jl:330](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L330)
- `+(T<:AbstractFloat)(r1::FloatRange{T<:AbstractFloat}, r2::FloatRange{T<:AbstractFloat})` at [operators.jl:337](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L337)
- `+(T<:AbstractFloat)(r1::LinSpace{T<:AbstractFloat}, r2::LinSpace{T<:AbstractFloat})` at [operators.jl:356](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L356)
- `+(r1::Union{FloatRange{T<:AbstractFloat}, LinSpace{T<:AbstractFloat}, OrdinalRange{T,S}}, r2::Union{FloatRange{T<:AbstractFloat}, LinSpace{T<:AbstractFloat}, OrdinalRange{T,S}})` at [operators.jl:369](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L369)
- `+(x::Ptr{T}, y::Integer)` at [pointer.jl:75](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pointer.jl#L75)
- `+(S,T)(A::Range{S}, B::Range{T})` at [arraymath.jl:69](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L69)
- `+(S,T)(A::Range{S}, B::AbstractArray{T,N})` at [arraymath.jl:87](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L87)
- `+(A::BitArray{N}, B::BitArray{N})` at [bitarray.jl:834](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/bitarray.jl#L834)
- `+(T)(B::BitArray{2}, J::UniformScaling{T})` at [linalg/uniformscaling.jl:28](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L28)
- `+(A::Array{T,2}, B::Diagonal{T})` at [linalg/special.jl:122](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122)
- `+(A::Array{T,2}, B::Bidiagonal{T})` at [linalg/special.jl:122](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122)
- `+(A::Array{T,2}, B::Tridiagonal{T})` at [linalg/special.jl:122](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122)
- `+(A::Array{T,2}, B::SymTridiagonal{T})` at [linalg/special.jl:131](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L131)
- `+(A::Array{T,2}, B::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}})` at [linalg/special.jl:159](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159)
- `+(A::Array{T,N}, B::SparseMatrixCSC{Tv,Ti<:Integer})` at [sparse/sparsematrix.jl:1019](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L1019)
- `+(P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period})`  
`(x::Union{DenseArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{P<:Union{Base.Dates.`  
at [dates/periods.jl:202](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L202)

- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L202>
- **+(A::AbstractArray{Bool,N}, x::Bool)** at [arraymath.jl:135](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L135)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L135>
- +  
**(A::Union{DenseArray{Bool,N},SubArray{Bool,N,A<:DenseArray{T,N}},I<:Tuple{Vararg{Union{Colon,Int64,Range{Int64}}}}},  
B::Union{DenseArray{Bool,N},SubArray{Bool,N,A<:DenseArray{T,N}},I<:Tuple{Vararg{Union{Colon,Int64,Range{Int64}}}}},**  
at [arraymath.jl:166](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L166)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L166>
- **+(A::SymTridiagonal{T}, B::SymTridiagonal{T})** at [linalg/tridiag.jl:84](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/tridiag.jl#L84)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/tridiag.jl#L84>
- **+(A::Tridiagonal{T}, B::Tridiagonal{T})** at [linalg/tridiag.jl:404](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/tridiag.jl#L404)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/tridiag.jl#L404>
- **+(A::UpperTriangular{T,S<:AbstractArray{T,2}}, B::UpperTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:347](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L347)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L347>
- **+(A::LowerTriangular{T,S<:AbstractArray{T,2}}, B::LowerTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:348](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L348)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L348>
- **+(A::UpperTriangular{T,S<:AbstractArray{T,2}}, B::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:349](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L349)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L349>
- **+(A::LowerTriangular{T,S<:AbstractArray{T,2}}, B::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:350](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L350)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L350>
- **+(A::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}}, B::UpperTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:351](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L351)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L351>
- **+(A::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}}, B::LowerTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:352](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L352)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L352>
- **+(A::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}},  
B::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:353](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L353)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L353>
- **+(A::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}},  
B::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}})** at [linalg/triangular.jl:354](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L354)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L354>
- **+(A::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}},**

- **B::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}}** at [linalg/triangular.jl:355](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L355)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/triangular.jl#L355>)
- **+(Da::Diagonal{T}, Db::Diagonal{T})** at [linalg/diagonal.jl:86](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/diagonal.jl#L86)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/diagonal.jl#L86>)
- **+(A::Bidiagonal{T}, B::Bidiagonal{T})** at [linalg/bidiag.jl:176](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/bidiag.jl#L176)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/bidiag.jl#L176>)
- **+(UL::UpperTriangular{T,S<:AbstractArray{T,2}}, J::UniformScaling{T<:Number})** at [linalg/uniformscaling.jl:45](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L45)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L45>)
- **+(UL::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}}, J::UniformScaling{T<:Number})** at [linalg/uniformscaling.jl:48](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L48)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L48>)
- **+(UL::LowerTriangular{T,S<:AbstractArray{T,2}}, J::UniformScaling{T<:Number})** at [linalg/uniformscaling.jl:45](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L45)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L45>)
- **+(UL::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}}, J::UniformScaling{T<:Number})** at [linalg/uniformscaling.jl:48](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L48)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L48>)
- **+(A::Diagonal{T}, B::Bidiagonal{T})** at [linalg/special.jl:121](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121>)
- **+(A::Bidiagonal{T}, B::Diagonal{T})** at [linalg/special.jl:122](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122>)
- **+(A::Diagonal{T}, B::Tridiagonal{T})** at [linalg/special.jl:121](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121>)
- **+(A::Tridiagonal{T}, B::Diagonal{T})** at [linalg/special.jl:122](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122>)
- **+(A::Diagonal{T}, B::Array{T,2})** at [linalg/special.jl:121](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121>)
- **+(A::Bidiagonal{T}, B::Tridiagonal{T})** at [linalg/special.jl:121](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121>)
- **+(A::Tridiagonal{T}, B::Bidiagonal{T})** at [linalg/special.jl:122](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L122>)
- **+(A::Bidiagonal{T}, B::Array{T,2})** at [linalg/special.jl:121](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121>)
- **+(A::Tridiagonal{T}, B::Array{T,2})** at [linalg/special.jl:121](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L121>)
- **+(A::SymTridiagonal{T}, B::Tridiagonal{T})** at [linalg/special.jl:130](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L130)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L130>)
- **+(A::Tridiagonal{T}, B::SymTridiagonal{T})** at [linalg/special.jl:131](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L131)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L131>)

- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L131>
- **+(A::SymTridiagonal{T}, B::Array{T,2})** at [linalg/special.jl:130](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L130)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L130>
- **+(A::Diagonal{T}, B::SymTridiagonal{T})** at [linalg/special.jl:139](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L139)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L139>
- **+(A::SymTridiagonal{T}, B::Diagonal{T})** at [linalg/special.jl:140](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L140)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L140>
- **+(A::Bidiagonal{T}, B::SymTridiagonal{T})** at [linalg/special.jl:139](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L139)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L139>
- **+(A::SymTridiagonal{T}, B::Bidiagonal{T})** at [linalg/special.jl:140](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L140)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L140>
- **+(A::Diagonal{T}, B::UpperTriangular{T,S<:AbstractArray{T,2}})** at [linalg/special.jl:151](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151>
- **+(A::UpperTriangular{T,S<:AbstractArray{T,2}}, B::Diagonal{T})** at [linalg/special.jl:152](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152>
- **+(A::Diagonal{T}, B::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}})** at [linalg/special.jl:151](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151>
- **+(A::Base.LinAlg.UnitUpperTriangular{T,S<:AbstractArray{T,2}}, B::Diagonal{T})** at [linalg/special.jl:152](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152>
- **+(A::Diagonal{T}, B::LowerTriangular{T,S<:AbstractArray{T,2}})** at [linalg/special.jl:151](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151>
- **+(A::LowerTriangular{T,S<:AbstractArray{T,2}}, B::Diagonal{T})** at [linalg/special.jl:152](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152>
- **+(A::Diagonal{T}, B::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}})** at [linalg/special.jl:151](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L151>
- **+(A::Base.LinAlg.UnitLowerTriangular{T,S<:AbstractArray{T,2}}, B::Diagonal{T})** at [linalg/special.jl:152](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L152>
- **+(A::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}}, B::SymTridiagonal{T})** at [linalg/special.jl:158](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158>
- **+(A::SymTridiagonal{T}, B::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}})** at [linalg/special.jl:159](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159>
- **+(A::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}}, B::Tridiagonal{T})** at [linalg/special.jl:158](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158>
- **+(A::Tridiagonal{T}, B::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}})** at [linalg/special.jl:159](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159>
- **+(A::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}}, B::Bidiagonal{T})** at [linalg/special.jl:158](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158)  
<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158>



- `+(A::Bidiagonal{T}, B::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}})` at [linalg/special.jl:159](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L159>)
- `+(A::Base.LinAlg.AbstractTriangular{T,S<:AbstractArray{T,2}}, B::Array{T,2})` at [linalg/special.jl:158](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/special.jl#L158>)
- `#{Tv1,Ti1,Tv2,Ti2}(A_1::SparseMatrixCSC{Tv1,Ti1}, A_2::SparseMatrixCSC{Tv2,Ti2})` at [sparse/sparsematrix.jl:1005](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L1005)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L1005>)
- `+(A::SparseMatrixCSC{Tv,Ti<:Integer}, B::Array{T,N})` at [sparse/sparsematrix.jl:1017](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L1017)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L1017>)
- `+(A::SparseMatrixCSC{Tv,Ti<:Integer}, J::UniformScaling{T<:Number})` at [sparse/sparsematrix.jl:2988](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L2988)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/sparse/sparsematrix.jl#L2988>)
- `#{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period}}`  
`(Y::Union{DenseArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N}})` at [dates/periods.jl:216](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L216)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L216>)
- `+`  
`{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},Q<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period}}`  
`(X::Union{DenseArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N}})`  
`(Y::Union{DenseArray{Q<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{Q<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N}})` at [dates/periods.jl:217](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L217)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L217>)
- `#{T<:Base.Dates.TimeType,P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period}}`  
`(x::Union{DenseArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N}})`  
`(y::T<:Base.Dates.TimeType)` at [dates/arithmetic.jl:83](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl#L83)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl#L83>)
- `#{T<:Base.Dates.TimeType}(r::Range{T<:Base.Dates.TimeType}, x::Base.Dates.Period)` at [dates/ranges.jl:39](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/ranges.jl#L39)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/ranges.jl#L39>)
- `#{T<:Number}(x::AbstractArray{T<:Number,N})` at [abstractarraymath.jl:49](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/abstractarraymath.jl#L49)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/abstractarraymath.jl#L49>)
- `#{S,T}(A::AbstractArray{S,N}, B::Range{T})` at [arraymath.jl:78](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L78)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L78>)
- `#{S,T}(A::AbstractArray{S,N}, B::AbstractArray{T,N})` at [arraymath.jl:96](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L96)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L96>)
- `+(A::AbstractArray{T,N}, x::Number)` at [arraymath.jl:139](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L139)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L139>)
- `+(x::Number, A::AbstractArray{T,N})` at [arraymath.jl:140](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L140)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/arraymath.jl#L140>)
- `+(x::Char, y::Integer)` at [char.jl:42](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/char.jl#L42)

- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/char.jl#L42>
- `+{N}(index1::CartesianIndex{N}, index2::CartesianIndex{N})` at [multidimensional.jl:42](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/multidimensional.jl#L42)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/multidimensional.jl#L42>
- `+(J1::UniformScaling{T<:Number}, J2::UniformScaling{T<:Number})` at [linalg/uniformscaling.jl:27](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L27)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L27>
- `+(J::UniformScaling{T<:Number}, B::BitArray{2})` at [linalg/uniformscaling.jl:29](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L29)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L29>
- `+(J::UniformScaling{T<:Number}, A::AbstractArray{T,2})` at [linalg/uniformscaling.jl:30](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L30)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L30>
- `+(J::UniformScaling{T<:Number}, x::Number)` at [linalg/uniformscaling.jl:31](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L31)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L31>
- `+(x::Number, J::UniformScaling{T<:Number})` at [linalg/uniformscaling.jl:32](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L32)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L32>
- `+{TA,TJ}(A::AbstractArray{TA,2}, J::UniformScaling{TJ})` at [linalg/uniformscaling.jl:92](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L92)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/linalg/uniformscaling.jl#L92>
- `+{T}(a::Base.Pkg.Resolve.VersionWeights.HierarchicalValue{T},  
b::Base.Pkg.Resolve.VersionWeights.HierarchicalValue{T})` at [pkg/resolve/versionweight.jl:23](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L23)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L23>
- `+(a::Base.Pkg.Resolve.VersionWeights.VWPreBuildItem, b::Base.Pkg.Resolve.VersionWeights.VWPreBuildItem)` at [pkg/resolve/versionweight.jl:85](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L85)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L85>
- `+(a::Base.Pkg.Resolve.VersionWeights.VWPreBuild, b::Base.Pkg.Resolve.VersionWeights.VWPreBuild)` at [pkg/resolve/versionweight.jl:131](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L131)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L131>
- `+(a::Base.Pkg.Resolve.VersionWeights.VersionWeight, b::Base.Pkg.Resolve.VersionWeights.VersionWeight)` at [pkg/resolve/versionweight.jl:185](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L185)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/versionweight.jl#L185>
- `+(a::Base.Pkg.Resolve.MaxSum.FieldValues.FieldValue, b::Base.Pkg.Resolve.MaxSum.FieldValues.FieldValue)` at [pkg/resolve/fieldvalue.jl:44](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/fieldvalue.jl#L44)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/pkg/resolve/fieldvalue.jl#L44>
- `+{P<:Base.Dates.Period}(x::P<:Base.Dates.Period, y::P<:Base.Dates.Period)` at [dates/periods.jl:43](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L43)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L43>
- `+(x::Base.Dates.Period, y::Base.Dates.Period)` at [dates/periods.jl:190](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L190)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L190>
- `+(x::Base.Dates.CompoundPeriod, y::Base.Dates.Period)` at [dates/periods.jl:191](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L191)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L191>
- `+(y::Base.Dates.Period, x::Base.Dates.CompoundPeriod)` at [dates/periods.jl:192](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L192)

- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L192>
- `+(x::Base.Dates.CompoundPeriod, y::Base.Dates.CompoundPeriod)` at [dates/periods.jl:193](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L193)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L193>
- `+(x::Base.Dates.CompoundPeriod, y::Base.Dates.TimeType)` at [dates/periods.jl:238](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L238)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L238>
- `+(y::Base.Dates.Period, x::Base.Dates.TimeType)` at [dates/arithmic.jl:66](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L66)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L66>
- `+(T<:Base.Dates.TimeType)(x::Base.Dates.Period, r::Range{T<:Base.Dates.TimeType})` at [dates/ranges.jl:40](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/ranges.jl#L40)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/ranges.jl#L40>
- `+(x::Union{Base.Dates.CompoundPeriod,Base.Dates.Period})` at [dates/periods.jl:201](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L201)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L201>
- `+(P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period})`  
`(x::Union{Base.Dates.CompoundPeriod,Base.Dates.Period},`  
`Y::Union{DenseArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{P<:Union{Base.Dates.C`  
at [dates/periods.jl:215](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L215)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L215>
- `+(dt::DateTime, y::Base.Dates.Year)` at [dates/arithmic.jl:13](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L13)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L13>
- `+(dt::Date, y::Base.Dates.Year)` at [dates/arithmic.jl:17](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L17)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L17>
- `+(dt::DateTime, z::Base.Dates.Month)` at [dates/arithmic.jl:37](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L37)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L37>
- `+(dt::Date, z::Base.Dates.Month)` at [dates/arithmic.jl:43](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L43)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L43>
- `+(x::Date, y::Base.Dates.Week)` at [dates/arithmic.jl:60](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L60)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L60>
- `+(x::Date, y::Base.Dates.Day)` at [dates/arithmic.jl:62](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L62)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L62>
- `+(x::DateTime, y::Base.Dates.Period)` at [dates/arithmic.jl:64](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L64)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L64>
- `+(x::Base.Dates.TimeType)` at [dates/arithmic.jl:8](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L8)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmic.jl#L8>
- `+(a::Base.Dates.TimeType, b::Base.Dates.Period, c::Base.Dates.Period)` at [dates/periods.jl:227](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L227)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L227>
- `+(a::Base.Dates.TimeType, b::Base.Dates.Period, c::Base.Dates.Period, d::Base.Dates.Period...)` at [dates/periods.jl:229](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L229)
- <https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L229>

- `+(x::Base.Dates.TimeType, y::Base.Dates.CompoundPeriod)` at [dates/periods.jl:233](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl:233)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/periods.jl#L233>)
- `+(x::Base.Dates.Instant)` at [dates/arithmetic.jl:4](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl:4)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl#L4>)
- `#{T<:Base.Dates.TimeType}(x::AbstractArray{T<:Base.Dates.TimeType,N}, y::Union{Base.Dates.CompoundPeriod,Base.Dates.Period})` at [dates/arithmetic.jl:76](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl:76)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl#L76>)
- `#{T<:Base.Dates.TimeType}(y::Union{Base.Dates.CompoundPeriod,Base.Dates.Period}, x::AbstractArray{T<:Base.Dates.TimeType,N})` at [dates/arithmetic.jl:77](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl:77)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl#L77>)
- `#{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period}}(y::Base.Dates.TimeType, x::Union{DenseArray{P<:Union{Base.Dates.CompoundPeriod,Base.Dates.Period},N},SubArray{P<:Union{Base.Dates.C` at [dates/arithmetic.jl:84](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl:84)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/dates/arithmetic.jl#L84>)
- `+(a, b, c, xs...)` at [operators.jl:103](https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl:103)  
(<https://github.com/JuliaLang/julia/tree/2ac304dfba75fad148d4070ef4f8a2e400c305bb/base/operators.jl#L103>)

In [4]: `# Let's add a new + methods for the Point type`

```
import Base.+
+(a::Point, b::Point) = Point(a.x + b.x, a.y + b.y)
```

Out[4]: `+ (generic function with 172 methods)`

In [5]: `Point(1.0,2.0) + Point(3.0,4.0)`

Out[5]: `Point{Float64}(4.0,6.0)`

```
In [7]: # Why Julia is fast? Pick the right method and do the right amount of work
# Multiple Dispatch makes it easy to organize programs into different behaviours
# The compiler can pick the most special behaviour for the fastest execution

@code_native Point(1.0,2.0) + Point(3.0,4.0)
```

```
        .section          __TEXT,__text,regular,pure_instructions
Filename: In[4]
Source line: 4
        pushq   %rbp
        movq   %rsp, %rbp
Source line: 4
        movsd  (%rsi), %xmm0
        movsd  8(%rsi), %xmm1
Source line: 4
        addsd  (%rdx), %xmm0
        addsd  8(%rdx), %xmm1
        movsd  %xmm1, 8(%rdi)
        movsd  %xmm0, (%rdi)
        movq   %rdi, %rax
        popq   %rbp
        ret
```

```
In [8]: # Let's try to get to matrix multiplication

import Base.*
*(a::Point, b::Point) = Point(a.x * b.x - a.y * b.y, a.y * b.x + a.x * b.y)
```

```
Out[8]: * (generic function with 139 methods)
```

```
In [17]: # Use comprehensions to create a random matrix of Points

A = [ Point(rand(),rand()) for i=1:5, j=1:5 ]
```

```
Out[17]: 5x5 Array{Point{Float64},2}:
 Point{Float64}(0.47505064620192883,0.8243753962519378) ... Point{Float64}(0.0699303396068014,
 Point{Float64}(0.06240865426863951,0.18262544118915414) Point{Float64}(0.6014849971120297,
 Point{Float64}(0.8882480752997501,0.11428465042726565) Point{Float64}(0.7059614326194741,
 Point{Float64}(0.716421397583451,0.5519208330384608) Point{Float64}(0.7605090145521005,
 Point{Float64}(0.16510560870080115,0.39476729812210865) Point{Float64}(0.7417662869684922,
```

```
In [10]: A*A
```

```
LoadError: MethodError: `zero` has no method matching zero(::Type{Point{Float64}})
while loading In[10], in expression starting on line 1
```

```
in _generic_matmatmul! at linalg/matmul.jl:470
in generic_matmatmul! at linalg/matmul.jl:445
in * at linalg/matmul.jl:132
```

```
In [15]: import Base.zero
zero{T}(::Type{Point{T}}) = Point(zero(T), zero(T))
```

```
Out[15]: zero (generic function with 14 methods)
```

```
In [138]: A*A
```

```
Out[138]: 5x5 Array{Point{Float64},2}:
 Point{Float64}(-0.04554527104409692,2.1030424187840535) ... Point{Float64}(0.5849986385840079,
 Point{Float64}(0.1593127495484561,1.2743987401102095) ... Point{Float64}(0.5009620298894122,
 Point{Float64}(1.2021362218237734,2.5417597651682535) ... Point{Float64}(1.2658478493246834,
 Point{Float64}(0.3157140829497066,2.1223220170116375) ... Point{Float64}(0.3231820201482104,
 Point{Float64}(0.9316342117048305,1.7572152199453253) ... Point{Float64}(1.5201068219591227,
```

## RLEVectors.jl

## Debugger demo

So, we now know that Julia is composable

How do we work with data? - DataFrames.jl

```
In [19]: using DataFrames
```

```
In [21]: v = ["x","y","z"][rand(1:3, 10^4)];  
df = DataFrame(Any[collect(1:10^4), v, rand(10^4)], [:A, :B, :C])
```

Out[21]:

	A	B	C
1	1	z	0.05912767123600848
2	2	z	0.19640552861681382
3	3	y	0.46618442164926255
4	4	x	0.3523760931780524
5	5	z	0.45494282834946453
6	6	z	0.5729658272524141
7	7	z	0.23037315722729135
8	8	z	0.5440549378915875
9	9	y	0.684496070434268
10	10	y	0.32477833691341607
11	11	y	0.20962477013524117
12	12	y	0.23367205624316156
13	13	z	0.4520624164770095
14	14	y	0.9294168945999208
15	15	x	0.4476664091230851
16	16	x	0.6595014831821984
17	17	z	0.8020623735926138
18	18	y	0.18248116941483694
19	19	z	0.18953972333787417
20	20	z	0.44114340172365085
21	21	x	0.3101659341634062
22	22	x	0.6752615475302539

<b>23</b>	23	x	0.8322961580194035
<b>24</b>	24	z	0.9111082092530258
<b>25</b>	25	x	0.8149112711436584
<b>26</b>	26	x	0.3535331629536176
<b>27</b>	27	z	0.804528212681962
<b>28</b>	28	z	0.8656804700825365
<b>29</b>	29	x	0.917240076566769
<b>30</b>	30	z	0.8359959957011656
⋮	⋮	⋮	⋮

In [22]: **function** doloop(df)

    A = df[:,A]

    s = 0

**for** i=1:length(A)

        s += A[i]

**end**

**end**

Out[22]: doloop (generic function with 1 method)

In [120]: t1 = @elapsed doloop(df)

Out[120]: 0.002105281

In [48]: **function** dosum(v)

    s = zero(eltype(v))

**for** i=1:length(v)

        s += v[i]

**end**

    s

**end**

Out[48]: dosum (generic function with 1 method)



```
In [122]: t_Vector = @elapsed dosum(df[:A])
```

```
Out[122]: 1.8258e-5
```

```
In [137]: doloop_dosum(df) = dosum(df[:A])
          @time doloop_dosum(df)
```

```
0.002250 seconds (632 allocations: 29.695 KB)
```

```
Out[137]: 50005000
```

```
In [53]: @code_warntype doloop(df)
```

Variables:

```
df::DataFrames.DataFrame
A::ANY
s::ANY
#s52::ANY
i::ANY
##selected_column#8362::Int64
```

Body:

```
begin # In[22], line 2:
  ##selected_column#8362 = (DataFrames.getindex)((top(getfield))(df::DataFrames.DataFrame, :
  A = (Base.arrayref)((top(getfield))(df::DataFrames.DataFrame, :columns)::Array{Any,1}, ##se
  s = 0 # In[22], line 5:
  GenSym(0) = (Main.colon)(1, (Main.length)(A)::ANY)::ANY
  #s52 = (top(start))(GenSym(0))::ANY
  unless (top(!))((top(done))(GenSym(0), #s52)::ANY)::ANY goto 1
  2:
  GenSym(1) = (top(next))(GenSym(0), #s52)::ANY
  i = (top(getfield))(GenSym(1), 1)::ANY
  #s52 = (top(getfield))(GenSym(1), 2)::ANY # In[22], line 6:
  s = s + (Main.getindex)(A, i)::ANY::ANY
  3:
  unless (top(!))((top(!))((top(done))(GenSym(0), #s52)::ANY)::ANY)::ANY goto 2
  1:
  0:
  return
end::Void
```

```
In [56]: @code_warntype dosum(1:100)
```

Variables:

```
v::UnitRange{Int64}
s::Int64
#s52::Int64
i::Int64
```

Body:

```
begin # In[48], line 2:
  s = 0 # In[48], line 4:
  GenSym(2) = (Base.box)(Int64, (Base.checked_sadd)((Base.box)(Int64, (Base.checked_ssub)((to
  GenSym(0) = $(Expr(:new, UnitRange{Int64}, 1, :((top(getfield))(Base.Intrinsics, :select_
  #s52 = (top(getfield))(GenSym(0), :start)::Int64
  unless (Base.box)(Base.Bool, (Base.not_int)(#s52::Int64 === (Base.box)(Base.Int, (Base.add_
  2:
  GenSym(4) = #s52::Int64
  GenSym(5) = (Base.box)(Base.Int, (Base.add_int)(#s52::Int64, 1))
  i = GenSym(4)
  #s52 = GenSym(5) # In[48], line 5:
  GenSym(3) = (Main.getindex)(v::UnitRange{Int64}, i::Int64)::Int64
  s = (Base.box)(Base.Int, (Base.add_int)(s::Int64, GenSym(3)))
  3:
  unless (Base.box)(Base.Bool, (Base.not_int)((Base.box)(Base.Bool, (Base.not_int)(#s52::Int6
  1:
  0: # In[48], line 7:
  return s::Int64
end::Int64
```

## The DataArrays approach - with NA values

```
In [128]: nadata = DataArray(collect(1:10^4))
          nadata[2] = NA
```

```
Out[128]: NA
```

```
In [130]: t_DataVector = @elapsed dosum(nadata)
```

```
Out[130]: 0.000374133
```

```
In [131]: t_DataVector/t_Vector
```

```
Out[131]: 20.491455800197173
```

```
In [65]: @code_warntype dosum(n2)
```

Variables:

```
v::DataArrays.DataArray{Int64,1}
s::ANY
#s52::Int64
i::Int64
```

Body:

```
begin # In[48], line 2:
  s = 0 # In[48], line 4:
  GenSym(2) = (top(getfield))(v::DataArrays.DataArray{Int64,1},:data)::Array{Int64,1}
  GenSym(3) = (Base.arraylen)(GenSym(2))::Int64
  GenSym(0) = $(Expr(:new, UnitRange{Int64}, 1, :(((top(getfield))(Base.Intrinsics,:select_
#s52 = (top(getfield))(GenSym(0),:start)::Int64
unless (Base.box)(Base.Bool,(Base.not_int)(#s52::Int64 === (Base.box)(Base.Int,(Base.add_
2:
GenSym(4) = #s52::Int64
GenSym(5) = (Base.box)(Base.Int,(Base.add_int)(#s52::Int64,1))
i = GenSym(4)
#s52 = GenSym(5) # In[48], line 5:
s = s::UNION{DATAARRAYS.NATYPE,INT64} + (Main.getindex)(v::DataArrays.DataArray{Int64,1},
3:
unless (Base.box)(Base.Bool,(Base.not_int)((Base.box)(Base.Bool,(Base.not_int)(#s52::Int6
1:
0: # In[48], line 7:
return s::UNION{DATAARRAYS.NATYPE,INT64}
end::UNION{DATAARRAYS.NATYPE,INT64}
```

## The NullableArrays approach

```
In [95]: using NullableArrays
n = NullableArray(collect(1:10^4))
```

```
Out[95]: 10000-element NullableArrays.NullableArray{Int64,1}:
 1
 2
 3
 4
 5
 6
 7
 8
 9
10
11
12
13
 ⋮
9989
9990
9991
9992
9993
9994
9995
9996
9997
9998
9999
10000
```

```
In [133]: zero(::Type{Nullable{Int64}}) = Nullable(0)
t_Nullables = @elapsed dosum(n)
```

```
Out[133]: 3.0955e-5
```

```
In [134]: t_Nullables/t_Vector
```

```
Out[134]: 1.6954211852338699
```

```
In [ ]:
```