Multi-letter identifiers have been changed to look better than they do with vanilla LaTeX: instead of *specifications*, you get *specifications*. The letters haven't been spread apart, and the ligature *fi* has been used.

`This is in typewriter font`

BirthdayBook

$$known : \mathbb{P}\, NAME$$
$$birthday : NAME \pfun DATE$$
$$known = \mathrm{dom}\, birthday$$

$$limit : \mathbb{N}$$
$$limit \leq 65536$$

Shape

$$colour : Colour$$

$$perim : \mathbb{R}$$
$$perim > 0$$

$$ini : State \times Occ \times T \fun Bool$$
$$\begin{array}{l} \forall\, S : State; i : Occ; t : T \bullet ini(S, i, t) \Leftrightarrow \\ \quad \theta(S\fun, 1, 0) \land \\ \quad\quad \exists\, t_1 : T \bullet \theta(\fun S, i, t_1) \land t_1 \leq t \land \forall\, t_2 : T \bullet t_2 < t \Rightarrow \neg \theta(S\fun, i + 1, t_2) \\ \quad \lor\, \theta(\fun S, 1, 0) \land \\ \quad\quad \exists\, t_1 : T \bullet \theta(\fun S, i, t_1) \land t_1 \leq t \land \forall\, t_2 : T \bullet t_2 < t \Rightarrow \neg \theta(S\fun, i, t_2) \end{array}$$

Let us see if `zbreak` works:

MakePlan

$c? : Company$ [The company that is making the plan]

$t? : Month$ [Time period]

$\Xi NFMM$

$\Xi AttrOfMarkets$ [OpenMarkets]

$\Xi Cost$

$\Xi AttrOfEconomy$ [Buying and selling price of quota]

$\Xi AttrOfQuota$

$\Xi AttrOfProduction$

$\Xi FishingLimitations$

$Plans! : Company \rightarrow Plan$

[The output is the plan for the company]

$\forall\, v : Vessel;\ f : Fishery;\ s : QuotaStock;\ p : Product;$
$l : Landing;\ t : Month;\ i : Input \bullet$
$\exists\, plan : Plan;\ Months : \mathbb{P}\, Month;$
$vs : \mathbb{P}\, Vessel;\ fs : \mathbb{P}\, Fishery;\ qs : \mathbb{P}\, QuotaStock;\ ls : \mathbb{P}\, Landing;$
$ps : \mathbb{P}\, Product;$
$catch : Vessel \times Fishery \times QuotaStock \pfun Tons;$
$MAXnet\_profit : Kronur;\ fishing\_cost : Kronur;$
$\quad production\_earnings : Kronur;$
$\quad production\_cost : Kronur;\ quota\_trading\_profit : Kronur;$
$fishing\_days : Vessel \times Fishery \times Month \pfun \mathbb{N};$
$value\_landing : Vessel \rightarrow Kronur;$
$export : Vessel \times Landing \times Month \pfun Tons;$
$\quad trade\_in, trade\_out : Landing \times Month \pfun Tons;$
$\quad prod : Product \times Month \rightarrow Tons;$
$quota\_rent\_in, quota\_rent\_out, quota\_next\_to,$
$\quad quota\_next\_from, quota\_exch\_to, quota\_exch\_from,$
$\quad quota\_trans\_from, quota\_trans\_to : Vessel \times QuotaStock \pfun Tons;$
$ExchangeCharge : \mathbb{Z};$
[charge for changing one species into another]
$quota\_used : Vessel \times QuotaStock \pfun Tons \bullet$

$Plans! = Plans! \oplus \{c? \mapsto plan\} \land$
$Months = t? \,..\, 12 \land$
$i \in Inputs \land$
$vs = Vessels\ c? \land v \in vs \land$
$fs = \{f : Fishery \mid f \in$
$\quad (\bigcup\{v : Vessel \mid v \in vs \bullet Fisheries(v)\}) \bullet f\} \land f \in fs \land$
$qs = \{s : QuotaStock;\ f : Fishery \mid$
$\quad f \in fs \land s \in QuotaStocks(f) \bullet s\} \land s \in qs \land$
$ls = \{s : QuotaStock;\ f : Fishery \mid f \in fs \land s \in qs \bullet$
$\quad Landings\ (f, s)\} \land l \in ls \land$
$ps = \{p : Product \mid$
$\quad p \in \bigcup\{fa : Factory \mid fa \in Factories\ c? \bullet Products(fa)\} \bullet p\} \land$
$p \in ps \land$

[The overall goal is to maximize net profits]

$MAXnet\_profit = -fishing\_cost + production\_earnings +$
$\quad -production\_cost + quota\_trading\_profit \land$ [A.1]
$catch\ (v, f, s) = ExpCatch\ (v, f, s) *$ [A.4]
$\quad \sum_{t:Month \mid t \in Months} fishing\_days\ (v, f, t) \land$

[One of the prices LandingPrice or ExportPrice is always zero for any l]

$(\forall\, l \mid l \in ls \bullet LandingPrice(l) = 0 \lor ExportPrice(l) = 0 \land$
$\quad LandingPrice(l) \neq ExportPrice(l)) \land$
$value\_landing =$ [A.3]
$\quad \{v : Vessel \mid v \in vs \bullet v \mapsto$
$\quad \sum_{l:Landing \mid l \in ls} LandingPrice(l) * ExportPriceConst(l) *$
$\quad \sum_{f:Fishery \mid f \in fs} \sum_{s:QuotaStock \mid s \in qs} (SpeciesToLandings\ (s, f, l) * (catch\ (v, f, s))\} \land$
$fishing\_cost = \sum_{v:Vessel \mid v \in vs} Share(v) * value\_landing(v) +$
[A.2]
$\quad \sum_{f:Fishery \mid f \in fs} CostFishDay\ (v, f) *$
$\quad \sum_{t:Month \mid t \in Months} fishing\_days\ (v, f, t) \land$

$$production\_earnings = \quad [A.5]$$
$$\sum_{l:Landing|l\in ls} \sum_{t:Month|t\in Months} (ExportPrice\ (l,t)) * (1-0.002) * t) *$$
$$\sum_{v:Vessel|v\in vs} export\ (v,l,t)$$
$$- WetfishBuyingPrice(l) * (1-0.002) * t) * trade\_in\ (l,t)$$
$$+ WetfishSellingPrice(l) * (1-0.002) * t) * trade\_out\ (l,t)$$
$$+ \sum_{p:Product|p\in ps} ProductPrice\ (p,t) * (1-0.002) * t) *$$
$$\sum_{t:Month|t\in Months} prod\ (p,t) \wedge$$
$$production\_cost = \sum_{i:Input|i\in Inputs} InputCost(i) * \quad [A.6]$$
$$\sum_{p:Product|p\in ps} InputForProduct(p,i) *$$
$$\sum_{t:Month|t\in Months} prod(p,t) \wedge$$
$$ExchangeCharge = 0.005 * NextPrice(s) \wedge$$
$$quota\_trading\_profit = -(\sum_{s:QuotaStock|s\in qs} QuotaRentInPrice(s) *$$
$$\sum_{v:Vessel|v\in vs} quota\_rent\_in\ (v,s)) \quad [A.7]$$
$$+ \sum_{s:QuotaStock|s\in qs} QuotaRentOutPrice(s) *$$
$$\sum_{v:Vessel|v\in vs} quota\_rent\_out\ (v,s)$$
$$+ \sum_{s:QuotaStock|s\in qs} NextCharge * NextPrice(s) * (1 - InterestRate) *$$
$$\sum_{v:Vessel|v\in vs} quota\_next\_to\ (v,s)$$
$$+ \sum_{s:QuotaStock|s\in qs} NextPrice(s) * (1 - InterestRate) *$$
$$\sum_{v:Vessel|v\in vs} quota\_next\_from\ (v,s)$$
$$- ExchangeCharge * \sum_{v:Vessel|v\in vs} \sum_{s:QuotaStock|s\in qs} quota\_exch\_to(v,s)$$
$$- TransferCharge * \sum_{v:Vessel|v\in vs} \sum_{s:QuotaStock|s\in qs} quota\_trans\_to\ (v,s) \wedge$$
$$\sum_{f:Fishery|f\in fs} fishing\_days\ (v,f,t) \leq MaxTotFishingDays\ (v,t) \wedge \quad [A.9]$$

[A.6.1 Constraints on fishing time]

$$l \in ExportLandings \Rightarrow$$
$$\sum_{f:Fishery|f\in fs} \sum_{s:QuotaStock|s\in qs} \quad [A.10]$$
$$SpeciesToLandings\ (s,f,l) * ExpCatch(v,f,s) * fishing\_days(v,f,t) =$$
$$export\ (v,l,t) \wedge$$

[A.6.2 Processing and selling the catch]

$$l \notin ExportLandings \Rightarrow$$
$$\sum_{v:Vessel|v\in vs} \sum_{f:Fishery|f\in fs} \sum_{s:QuotaStock|s\in qs}$$
$$SpeciesToLandings\ (s,f,l) * ExpCatch\ (v,f,s) * fishing\_days\ (v,f,t)$$
$$= (1/LandingsToProducts\ (p,l)) * prod\ (p,t) - trade\_in\ (l,t) + trade\_out(l,t) \wedge \quad [A.11]$$

$\sum_{t:Month|t\in Months} \sum_{p:Product|p\in ps} InputForProduct(p,i) * prod(p,t)$
$\quad \leq \sum_{i:Input|i\in Inputs} MaxInput\ (i,t) \wedge$ [A.13]

$\sum_{t:Month|t\in Months} \sum_{p:Product|p\in ps} InputForProduct(p,i) * prod\ (p,t)$
$\quad \geq \sum_{i:Input|i\in Inputs} MinInput\ (i,t) \wedge$ [A.14]

$\sum_{t:Month|t\in Months} export\ (v,l,t) \leq MaxExport\ (v,l) \wedge$ [A.15]

[A.6.3 Constraints because of quota restrictions]

$quota\_used =$ [A.17]
$\quad \{v : Vessel;\ s : QuotaStock \mid v \in vs \wedge s \in qs \bullet$
$\quad\quad (v,s) \mapsto \sum_{f:Fishery|f\in fs}(1 + QuotaSurcharge\ (s,f)) *$
$\quad\quad catch\ (v,f,s)\} \wedge$

$\sum_{v:Vessel|v\in vs} quota\_trans\_to(v,s) - quota\_trans\_from(v,s) = 0 \wedge$ [A.18]

$quota\_used(v,s) - quota\_rent\_in(v,s) + quota\_rent\_out(v,s) -$ [A.16]
$\quad quota\_exch\_to(v,s) + quota\_exch\_from(v,s) -$
$\quad quota\_trans\_to(v,s) + quota\_trans\_from(v,s) -$
$\quad quota\_next\_to\ (v,s) + quota\_next\_from\ (v,s) \leq QuotaLeft\ (v,s) \wedge$

$s = Cod \Rightarrow MaxQuotaInto(v,s) = 0 \wedge$ [A.19]

$s \neq Cod \Rightarrow MaxQuotaInto(v,s) = 0.05 * QuotaAllocated(v,s) \wedge$
$\quad QuotaValueInto(s) * quota\_exch\_to(v,s) \leq$
$\quad\quad \sum_{s:QuotaStock|s\in qs} MaxQuotaInto\ (v,s) \wedge$

$\sum_{s:QuotaStock|s\in qs} QuotaValueInto(s) * quota\_exch\_to\ (v,s) -$ [A.20]
$\quad \sum_{s:QuotaStock|s\in qs} QuotaValueFrom(s) * quota\_exch\_from\ (v,s) = 0 \wedge$

$quota\_next\_from(v,s) \leq (QuotaOver(v,s)/100) * QuotaAllocated(v,s) \wedge$ [A.21]

$quota\_next\_to\ (v,s) \leq (QuotaUnder(v,s)/100) * QuotaAllocated(v,s) \wedge$ [A.22]

[Bounds]

$fishing\_days\ (v,f,t) \leq MaxFishingDays\ (f,t) \wedge$ [A.23]

$QuotaAllocated\ (v,s) = 0 \Rightarrow$
$\quad (quota\_exch\_to\ (v,s) = 0 \wedge$ [A.24]
$\quad quota\_rent\_in\ (v,s) = 0 \wedge$ [A.25]
$\quad quota\_trans\_to\ (v,s) = 0) \wedge$ [A.26]

$QuotaValueInto\ s = 0 \Rightarrow quota\_exch\_to\ (v,s) = 0 \wedge$ [A.27]

$QuotaValueFrom\ s = 0 \Rightarrow quota\_exch\_from\ (v,s) = 0$ [A.28]

$$
\begin{array}{l}
plan.c = c?\ plan.fishing\_days = fishing\_days \wedge plan.quota\_rent\_out = quota\_rent\_out \wedge \\
plan.quota\_rent\_in = quota\_rent\_in \wedge \\
plan.quota\_trans\_from = quota\_trans\_from \wedge \\
plan.quota\_trans\_to = quota\_trans\_to \wedge \\
plan.quota\_next\_from = quota\_next\_from \wedge \\
plan.quota\_next\_to = quota\_next\_to \wedge \\
plan.quota\_exch\_from = quota\_exch\_from \wedge \\
plan.quota\_exch\_to = quota\_exch\_to \wedge \\
plan.trade\_out = trade\_out \wedge \\
plan.trade\_in = trade\_in \wedge \\
plan.prod = prod \wedge \\
plan.export = export
\end{array}
$$