Retro Fantasy AFL Optimiser Formulation

January 23, 2026

1 Description

This model retrospectively determines the optimal AFL Fantasy team selection and trade sequence across the 2025 season.

For each round $r \in R$, it chooses which players $p \in P$ are in the squad and allocates them to the required on-field and bench slots (defence, midfield, ruck, forward, plus a bench utility slot). The objective is to maximise the total realised points scored by the on-field players across all rounds.

The model respects:

- **Positional structure**: each round has fixed counts for on-field and bench positional slots, plus exactly one bench utility.
- **Position eligibility**: a player may only be assigned to a position (F/M/U/D) if they are eligible for that position; players may be eligible for multiple positions.
- **Trade limits**: between consecutive rounds, at most two players may be traded in (and at most two traded out).
- **Budget / bank**: the initial bank is salary cap minus the cost of the starting squad, the bank balance is carried forward and updated each round using the round-r prices of traded-out and traded-in players, and the bank is never allowed to be negative.

This formulation is designed to be implemented as a mixed-integer linear program (MILP).

2 Sets

Let P, subscripted by p, be the set of players.

Let $R = \{1, 2, \dots, 24\}$, subscripted by r, be the set of rounds.

Let $F \subseteq P$ be the set of forwards.

Let $M \subseteq P$ be the set of midfielders.

Let $U \subseteq P$ be the set of rucks.

Let $D \subseteq P$ be the set of defenders.

3 Parameters (Vectors)

Let $s_{p,r}$ be the (known) number of points scored by player p in round r.

Let $c_{p,r}$ be the (known) price of player p in round r.

Let e_p^F be a binary parameter indicating whether player p is eligible to be selected as a forward (1 if eligible, 0 otherwise).

Let e_p^M be a binary parameter indicating whether player p is eligible to be selected as a midfielder (1 if eligible, 0 otherwise).

Let e_p^U be a binary parameter indicating whether player p is eligible to be selected as a ruck (1 if eligible, 0 otherwise).

Let e_p^D be a binary parameter indicating whether player p is eligible to be selected as a defender (1 if eligible, 0 otherwise).

4 Constants

Let SALARY_CAP be the starting salary cap.

5 Decision Variables

Let $x_{p,r}$ be a binary decision variable indicating whether player p is selected in the team (in any position, on-field or bench) in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{F,\mathrm{on}}$ be a binary decision variable indicating whether player p is selected as an on-field forward in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{M,\mathrm{on}}$ be a binary decision variable indicating whether player p is selected as an on-field midfielder in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{U,\mathrm{on}}$ be a binary decision variable indicating whether player p is selected as an on-field ruck in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{D,\mathrm{on}}$ be a binary decision variable indicating whether player p is selected as an on-field defender in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{F,\mathrm{bench}}$ be a binary decision variable indicating whether player p is selected as a bench forward in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{M,\mathrm{bench}}$ be a binary decision variable indicating whether player p is selected as a bench midfielder in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{U,\mathrm{bench}}$ be a binary decision variable indicating whether player p is selected as a bench ruck in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{D,\mathrm{bench}}$ be a binary decision variable indicating whether player p is selected as a bench defender in round r (1 if selected, 0 otherwise).

Let $x_{p,r}^{Q,\mathrm{bench}}$ be a binary decision variable indicating whether player p is selected in the bench utility position in round r (1 if selected, 0 otherwise).

Let b_r be a continuous decision variable representing the amount of cash in the bank in round r.

Let $\mathrm{in}_{p,r}$ be a binary decision variable indicating whether player p is traded into the team in round r (present in round r but not in round $r-1$).

Let $\mathrm{out}_{p,r}$ be a binary decision variable indicating whether player p is traded out of the team in round r (present in round $r-1$ but not in round r).

6 Objective Function

Maximise the total points scored by the on-field selected players across all rounds:

$$\text{Maximise} \quad \sum_{r \in R} \sum_{p \in P} s_{p,r} \cdot \left(x_{p,r}^{F,\text{on}} + x_{p,r}^{M,\text{on}} + x_{p,r}^{U,\text{on}} + x_{p,r}^{D,\text{on}} \right)$$

7 Constraints

7.1 Initial Bank Balance

Cash in the bank in round 1 is the salary cap minus the total price of the selected starting team:

$$b_1 = \text{SALARY\_CAP} - \sum_{p \in P} c_{p,1} \cdot x_{p,1}$$

7.2 Bank Non-negativity

The bank balance cannot be negative in any round:

$$b_r \geq 0 \quad \forall r \in R$$

7.3 Bank Balance Recurrence

The bank balance carries forward between rounds and is adjusted by the round-r prices of players traded out and traded in:

$$b_r = b_{r-1} + \sum_{p \in P} c_{p,r} \cdot \text{out}_{p,r} - \sum_{p \in P} c_{p,r} \cdot \text{in}_{p,r} \quad \forall r \in R \setminus \{1\}$$

7.4 Trade Indicator Linking

Trade-in and trade-out indicators are linked to changes in overall selection $x_{p,r}$. The following constraints linearise:

- $\text{in}_{p,r} = 1$ iff $(x_{p,r-1}, x_{p,r}) = (0, 1)$
- $\text{out}_{p,r} = 1$ iff $(x_{p,r-1}, x_{p,r}) = (1, 0)$

Lower bounds (force the indicator to switch on when a change occurs):

If the player was not selected in $r-1$ but is selected in r, then $x_{p,r} - x_{p,r-1} = 1$, which forces $\text{in}_{p,r} \geq 1$.

This is the "trigger" constraint for trade-ins.

$$\text{in}_{p,r} \geq x_{p,r} - x_{p,r-1} \quad \forall p \in P, \forall r \in R \setminus \{1\}$$

If the player was selected in $r-1$ but is not selected in r, then $x_{p,r-1} - x_{p,r} = 1$, which forces $\text{out}_{p,r} \geq 1$.

This is the "trigger" constraint for trade-outs.

$$\text{out}_{p,r} \geq x_{p,r-1} - x_{p,r} \quad \forall p \in P, \forall r \in R \setminus \{1\}$$

Upper bounds (prevent false positives / enforce the correct direction of change):

A trade-in can only occur if the player is selected in round r.

This prevents $\text{in}_{p,r} = 1$ when the player is not actually in the round-r team.

$$\text{in}_{p,r} \le x_{p,r} \quad \forall p \in P, \forall r \in R \setminus \{1\}$$

A trade-in can only occur if the player was not selected in round $r - 1$.

This prevents $\text{in}_{p,r} = 1$ when the player was already owned in round $r-1$ (i.e. no trade-in happened).

$$\text{in}_{p,r} \le 1 - x_{p,r-1} \quad \forall p \in P, \forall r \in R \setminus \{1\}$$

A trade-out can only occur if the player was selected in round $r - 1$.

This prevents $\text{out}_{p,r} = 1$ when the player wasn't owned in round $r - 1$.

$$\text{out}_{p,r} \le x_{p,r-1} \quad \forall p \in P, \forall r \in R \setminus \{1\}$$

A trade-out can only occur if the player is not selected in round r.

This prevents $\text{out}_{p,r} = 1$ when the player is still owned in round r.

$$\text{out}_{p,r} \le 1 - x_{p,r} \quad \forall p \in P, \forall r \in R \setminus \{1\}$$

7.5 Linking Constraints

Overall selection must match positional selection:

$$x_{p,r} = x_{p,r}^{F,\text{on}} + x_{p,r}^{M,\text{on}} + x_{p,r}^{U,\text{on}} + x_{p,r}^{D,\text{on}} + x_{p,r}^{F,\text{bench}} + x_{p,r}^{M,\text{bench}} + x_{p,r}^{U,\text{bench}} + x_{p,r}^{D,\text{bench}} + x_{p,r}^{Q,\text{bench}} \quad \forall p \in P, \forall r \in R$$

7.6 Maximum Team Changes Per Round

Between consecutive rounds, at most two players may differ in the selected team (players may change positions freely; this constraint applies only to $x_{p,r}$).

Using the trade indicators, this is enforced by limiting the number of trade-ins (equivalently trade-outs) each round:

$$\sum_{p \in P} \text{in}_{p,r} \le 2 \quad \forall r \in R \setminus \{1\}$$

$$\sum_{p \in P} \mathrm{out}_{p,r} \leq 2 \quad \forall r \in R \setminus \{1\}$$

7.7 Positional Structure

The team must have the following positional structure in every round.

On-field defenders:

$$\sum_{p \in P} x_{p,r}^{D,\text{on}} = 6 \quad \forall r \in R$$

Bench defenders:

$$\sum_{p \in P} x_{p,r}^{D,\text{bench}} = 2 \quad \forall r \in R$$

On-field midfielders:

$$\sum_{p \in P} x_{p,r}^{M,\text{on}} = 8 \quad \forall r \in R$$

Bench midfielders:

$$\sum_{p \in P} x_{p,r}^{M,\text{bench}} = 2 \quad \forall r \in R$$

On-field rucks:

$$\sum_{p \in P} x_{p,r}^{U,\text{on}} = 2 \quad \forall r \in R$$

Bench rucks:

$$\sum_{p \in P} x_{p,r}^{U,\text{bench}} = 1 \quad \forall r \in R$$

On-field forwards:

$$\sum_{p \in P} x_{p,r}^{F,\text{on}} = 6 \quad \forall r \in R$$

Bench forwards:

$$\sum_{p \in P} x_{p,r}^{F,\text{bench}} = 2 \quad \forall r \in R$$

Bench utility:

$$\sum_{p \in P} x_{p,r}^{Q,\text{bench}} = 1 \quad \forall r \in R$$

7.8 Position Eligibility

Players can only be selected into a position if they are eligible for that position (eligibility may be multi-position):

$$x_{p,r}^{F,\text{on}} \leq e_p^F \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{F,\text{bench}} \leq e_p^F \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{M,\text{on}} \leq e_p^M \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{M,\text{bench}} \leq e_p^M \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{U,\text{on}} \leq e_p^U \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{U,\text{bench}} \leq e_p^U \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{D,\text{on}} \leq e_p^D \quad \forall p \in P, \forall r \in R$$

$$x_{p,r}^{D,\text{bench}} \leq e_p^D \quad \forall p \in P, \forall r \in R$$

8 Notes / Implementation Mapping