A Model of Cattle Breeders and a Feedlot

# 1 System/Model Description

## Cattle

* According to [www.livestocklibrary.com.au/bitstream/handle/1234/20038/19Greenwood.pdf](http://www.livestocklibrary.com.au/bitstream/handle/1234/20038/19Greenwood.pdf), ***average birth weight*** is between 28.6 (growth–retarded during fetal life due to severely restricted maternal nutrition) and 38.8 kg (well–grown).

### Model

* Birth weight is N(38,5) kg, which means normally distr. with mean/stdDev = 38/5 kg

## Breeder

* According to [www.livestocklibrary.com.au/bitstream/handle/1234/20038/19Greenwood.pdf](http://www.livestocklibrary.com.au/bitstream/handle/1234/20038/19Greenwood.pdf), pre–weaning (7 mo) average daily weight gain (DWG) is between 670 and 759 g, backgrounding average DWG is between 571 and 603 g.

### Model

* The difference between pre–weaning and post–weaning is ignored
* Each day, the DWG is N(600,50) g
* Each day a random number of calves is born: uniformly distributed between 0 and the current open capacity of the breeder.
* As soon as a breeder has a certain number of feedlot-entry-mature cattle (determined by a minimum batch size), the feedlot buys them if it has enough free capacity, that is, a corresponding *Purchase* event is created.

## Feedlot

* According to the spreadsheet data,
  + Purchase lot size is (roughly estimated) from 10-45 cattle (TODO: analyze spreadsheet data for getting a justified distribution!)
  + Purchase price per cattle is between 540 and 1642 AUD, with an average of 1258 AUD
  + The (nominal) arrival weight is determined by dividing the average price per animal by a nominal price of 3 AUD/kg
  + Arrival weight is from 180 kg to 547 kg with an average of 419 kg, and days on feed are between 0 and 279 with an average of 39;
  + Feed costs per day are fixed at 3.20 AUD.
  + All cattle from a purchase lot are sold (to the slaughterhouse) at the same time for the same fixed per kg price of 6,50 AUD based on their measured carcass weight.
* According to [www.livestocklibrary.com.au/bitstream/handle/1234/20038/19Greenwood.pdf](http://www.livestocklibrary.com.au/bitstream/handle/1234/20038/19Greenwood.pdf), feedlot entry weight (at 26 mo) is between 481 and 520 kg, feedlot average DWG is between 1480 and 1617 g, feedlot exit weight (at 30 mo) is between 647 and 703 kg.
* ADD: (daily) fixed costs
* ADD age-based weight gain
* ADD/CHANGE: sales decision should be based on profitability (e.g. sufficient eight gain)

### Model

* There is only one feedlot
* Each day, the DWG is N(1600,100) g
* As soon as a feedlot has a certain number of slaughter-ready cattle (determined by a minimum batch size), it sells them (to an imaginary infinitely buying slaughterhouse), that is, a corresponding *Sale* event is created.
* As soon as the free capacity of the feedlot falls below a certain threshold, it purchases feedlot-mature cattle from its preferred/potential suppliers, that is, a corresponding *Restocking* event is created.

## Purchase

* According to the spreadsheet data, a batch of cattle is purchased for a certain amount such that a nominal weight is determined by dividing the average price per animal by a nominal price of 3 AUD/kg.

### Model

* Triggered by the feedlot capacity utilization falling below a threshold.

## Sale

* Feedlots track weight gains and decide to sell based on this gain with some random delay (depending on the availability of the slaughterhouse).
* Batch size for selling cattle: 30.

# 2 Possible Extensions

During transport (for 200-300 km), depending on the stress level (e.g., created by the driving behavior of the driver) up to 10% of weight can be lost

# 3 Questions

* How many actors/organizations will be involved in a model of a complete BeefLedger supply chain? 1) breeders, 2) feedlots 3) slaughterhouses 4) transport logistics providers 5) wholesalers, 6) retailers, 7) consumers

# 4 Information Model

An information model defines object types and event types with properties/attributes and associations.



## Event rules

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| ON Restocking( feedlot) |
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