

Ask the question

Select the
modeling
approach

Formulate the
model

Solve the model

Answer the
question

Optimizing profit when selling a pig

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Modeling Approach

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- Guided by the five-step approach
- Be accurate and use real-world information when it's readily available, but don't fret a few generalizations
- In terms of factors affecting the problem, keep the problem as complex as it's stated (i.e. don't oversimplify or over-complicate)

The Five Step Method

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- Define the problem
- This is given in the report description!
- “Given a starting weight of 200 lb, \$0.45 daily feed cost, \$0.65 initial market price per pound of pork, when should I sell my pig?”

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- Define the scope and methodology of the problem that we'll model
- We'll consider formulas for determining the pig's daily weight gain, the daily maintenance cost, and daily market price per pound of pork as single-variable functions for a given time t , where t represents each day since the start
- We'll essentially limit ourselves to values of t less than 30 to reasonably limit our scope

Select the modeling approach

- To find a good formula for weight, we'll inform our decision by looking at the simple, 5 pounds per day model, the complex formula given in the report description, and some real world data
- To find a good formula for market price per pound of pork, we'll quickly go beyond the scope of the problem by looking at real-world market prices, so we'll stick to the formulas given in class
- To find a good formula for the cost of maintaining a pig, we'll go beyond the scope of the problem if we look at real-world market prices per pound of feed, but real world data could be useful for finding out how much feed a pig eats as it grows bigger.

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- Determine analytic formulas for solving the prior three major factors impacting the problem
 - weight
 - pork price
 - maintenance cost

Pig Weight over Time

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- Simple weight function, $w(t) = 200 + 5t$
- Unrealistically-overestimating weight function,
$$w(t) = \frac{800}{1+3e^{\frac{-t}{30}}}$$
- More-realistic weight function, $w(t) = 125 + \frac{300}{1+3e^{\frac{-t}{30}}}$

Pig Weight over Time

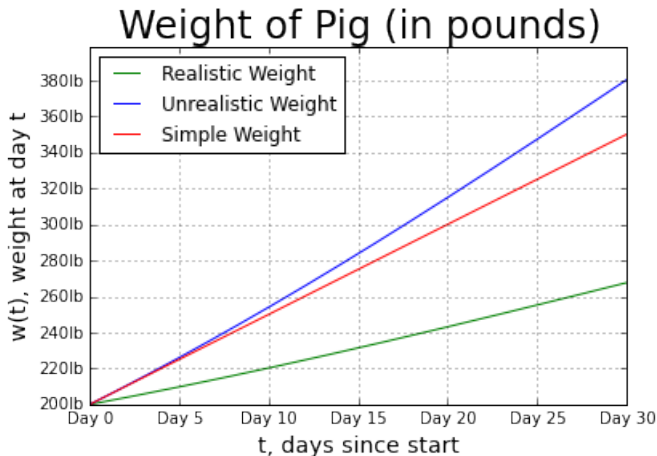
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Pork Price over Time

Ask the question

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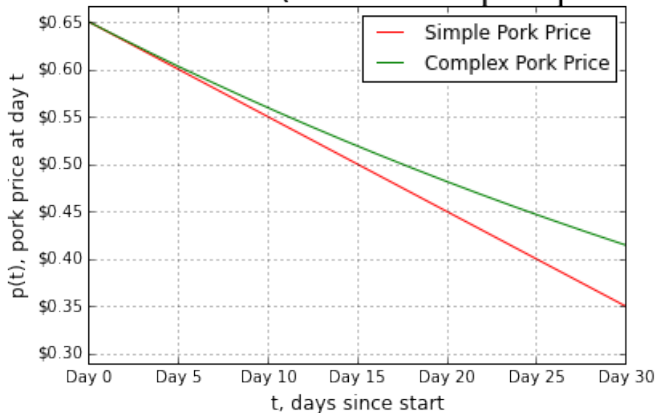
Solve the model

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- Simple pork price function, $p(t) = 0.65 - 0.01t$
- Complex pork price function, $p(t) = 0.65e^{\frac{-0.01t}{0.65}}$

Pork Price over Time

Price of Pork (in dollars per pound)



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Maintenance Cost over Time

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- Simple maintenance cost function, $c(t) = 0.45t$
- Complex maintenance cost function,
 $c(t) = 0.45t \times 2^{\frac{t}{70}}$
- Due to time constraints on the report, we only investigated the simple case, but the question is still open for the latter

Solve the model

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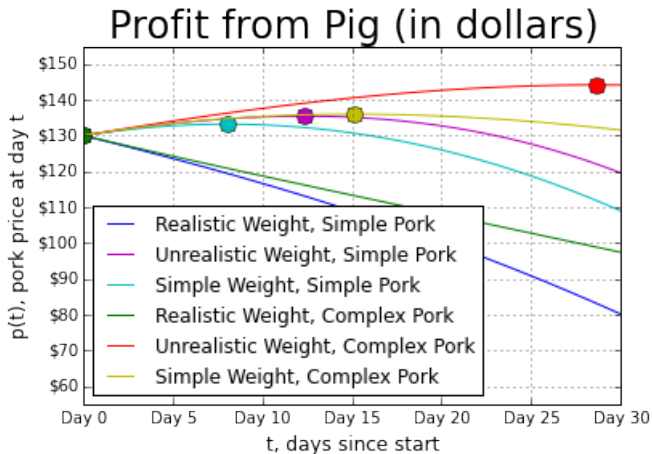
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- Fixed simple maintenance cost function as the only one compared of the two
- Solved for each variation of pork/weight functions using Newton's method

Solve the model

Solve the model



Solve the model

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Realistic Weight, Simple Pork	\$130.0 at time $t = 0.0$
Unrealistic Weight, Simple Pork	\$135.42 at time $t = 12.334$
Simple Weight, Simple Pork	\$133.2 at time $t = 8.003$
Realistic Weight, Complex Pork	\$130 at time $t = 0.0$
Unrealistic Weight, Complex Pork	\$144.16 at time $t = 28.64$
Simple Weight, Complex Pork	\$135.98 at time $t = 15.095$

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- We like the realistic weight, complex pork model the best, so we answer the question using the optimum value for it
- “Sell your pig immediately, and reap an easy \$130 in profit”