Decision Support Systems & Data Mining

How are Decision Support Systems and Data Mining Different?

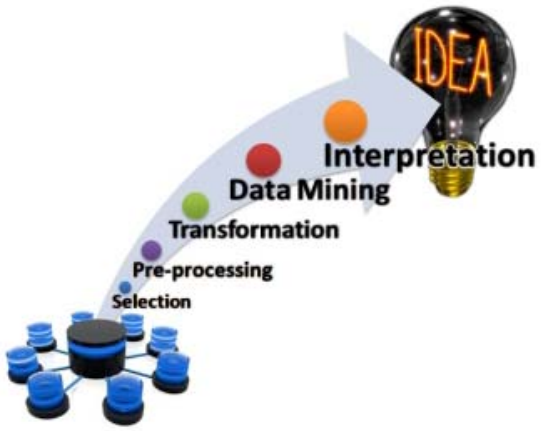
- **<u>Decision Support Systems</u>**:

  Provide the decision maker with an explicit mathematical formula that can be used to build various decision scenarios

$$z = 1.2(750 - y)$$
$$0 < z < 450, 375 < y < 750$$

- **<u>Data Mining</u>**:

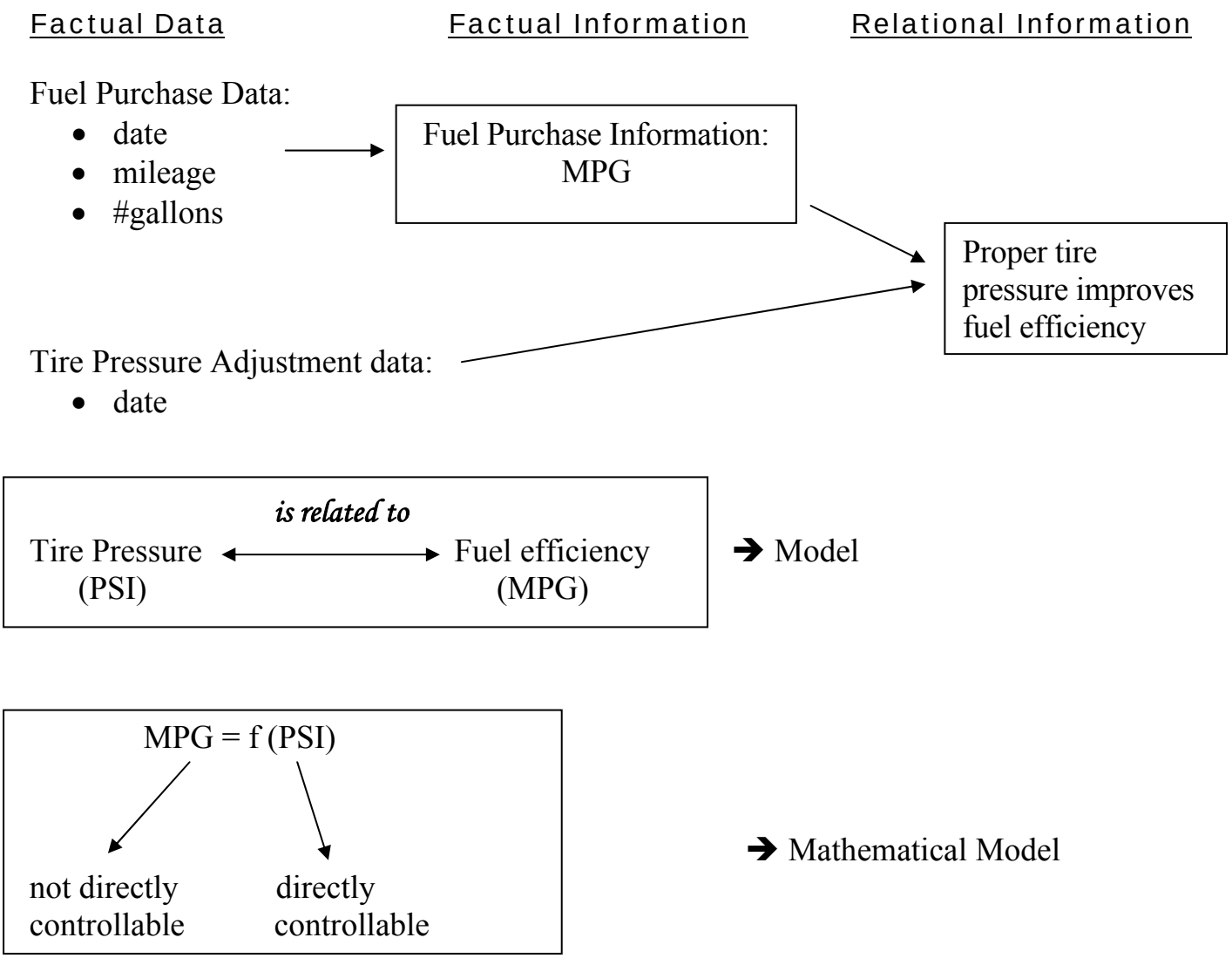
  Provides the decision maker with information about interesting relationships among variables that suggest certain decision scenarios



How are Decision Support Systems and Data Mining Similar?

They are both based on **<u>relational</u>**, rather than factual, **<u>information.</u>**

What is Relational Information, and where does it come from?



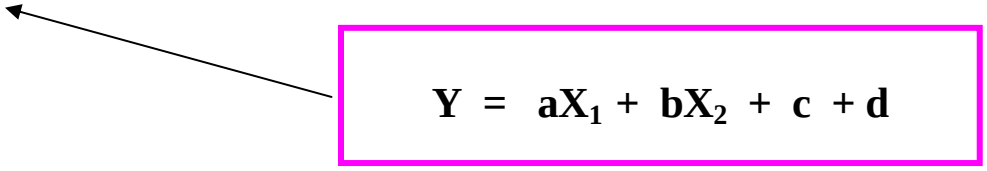
Why Build Models?

To control those things that cannot be controlled directly
via
controlling those things that CAN be controlled directly

Factual Information: What happens
Relational Information: How factors underlying what happens are related

The Anatomy of Mathematical Models

Mathematical Model



Y = Dependent/Outcome Variable
That which we want to control/predict, but cannot do so directly
It is the outcome/consequence of other factors that we can control directly

X_1 , X_2 = Independent/Decision/Controllable Variables
Those factors that we can control directly, and whose correct values are in doubt (hence the need for a DSS)

a, b, c, d = Decision Parameters, Uncontrollable Variables, Environmental Factors
Those factors that affect the Dependent/Outcome Variable but cannot be controlled by the decision maker; their values are "given" in a particular situation.

The Central Challenge of DSS:

- *Given certain values of a/b/c/d, what values of X_1/X_2 will produce the desired value of Y?*

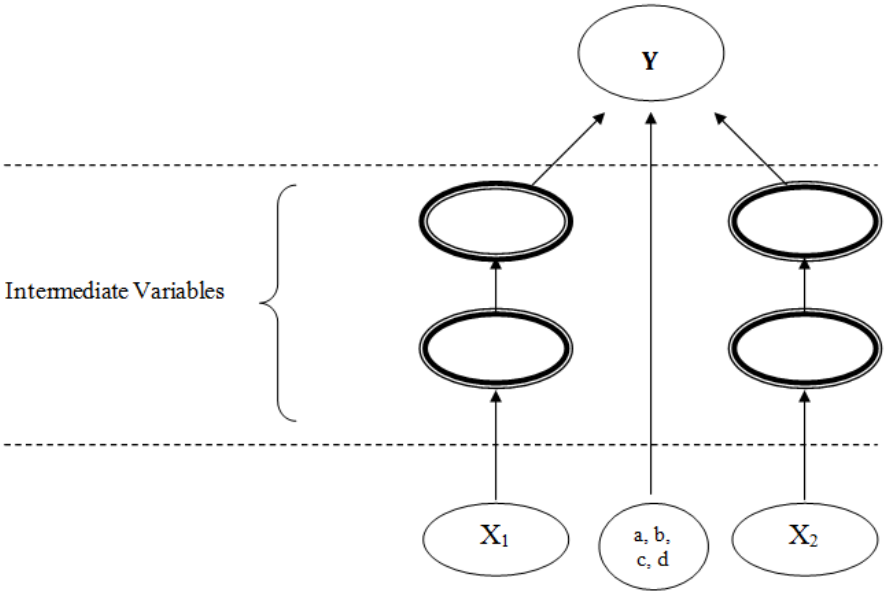
DSS ≠ DAS

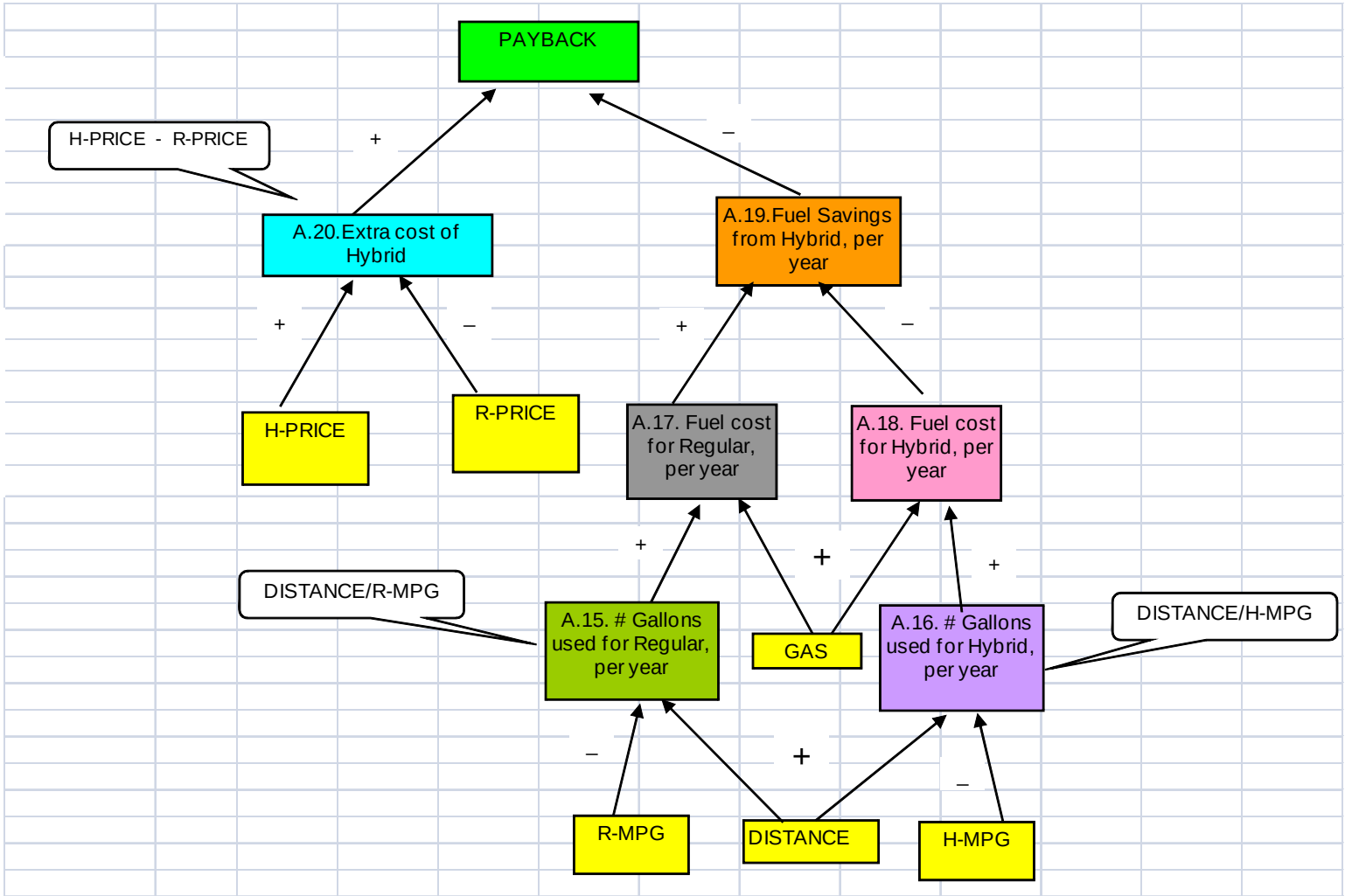
DSS = Decision Support Systems
A system that supports/aids the decision maker; the decision is made by the decision maker
➔ semi-structured decision situations

DAS = Decision Automation System
A system that replaces the decision maker; the decision is delegated to the computer
➔ Fully-structured decision situations

For a brief but useful textbook coverage of DSS, read An Introduction to DSS
http://zimmer.csufresno.edu/~sasanr/Teaching-Material/MIS/DSS/DSS-Intro.pdf

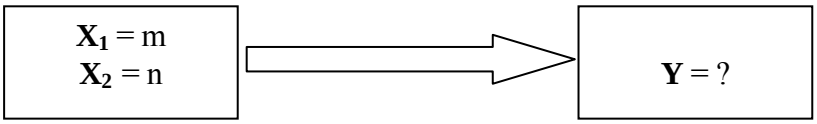
The role of Intermediate Variables in facilitating the derivation of the model:



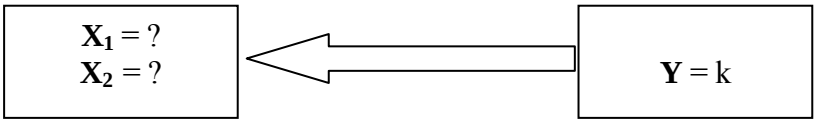


Using Mathematical Models

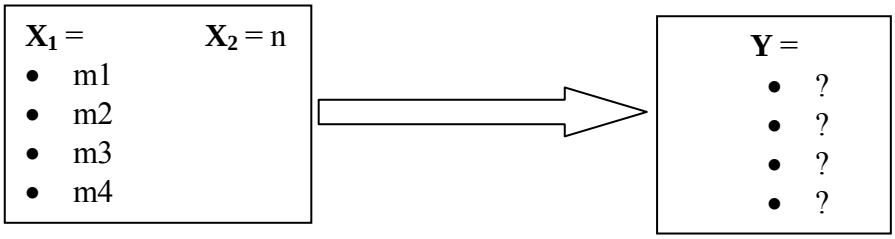
1. What-if Analysis:
   Given certain (hypothetical) values of the independent variables, what is the corresponding value of the dependent variable?



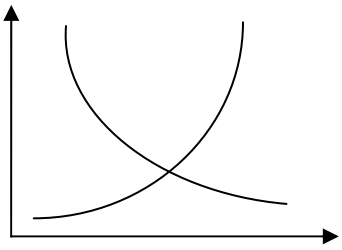
2. Goal-seek Analysis:
   Given a certain desired value of the dependent variable, what values of the independent variables would produce it?



3. Sensitivity Analysis:
   How sensitive is the dependent variable to changes in a certain independent variable when everything else is kept constant?



4. Optimization Analysis:
   When the independent variable should not be maximized or minimized because it involves a tradeoff, which value of it will optimize the independent variable?



A Case Study in Sensitivity Analysis

Question:

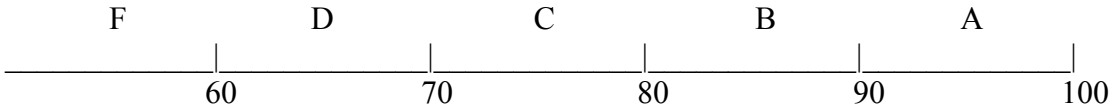
Which student's **Course Grade** is more sensitive to their **Term Paper Grade**?
➔
Which student's term paper should the professor read more carefully?

Background:

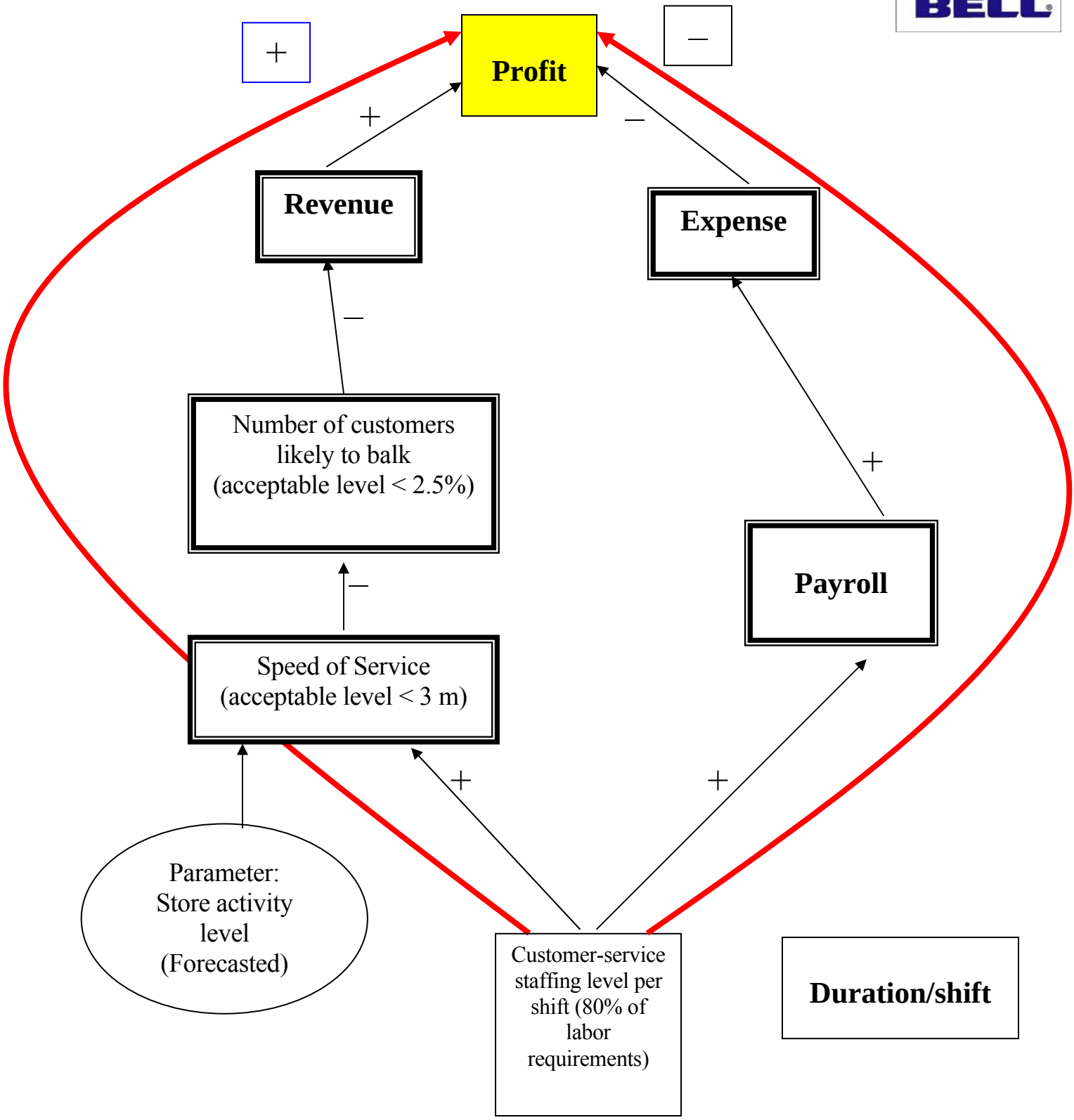
Both students S1 and S2 have met all the course requirements except the term paper (worth 10%)

Student	Total Score So Far (Max = 90%)	Term Paper Grade (Max=10%)	Course Grade (Max = 100%)
S1	78%	• A (9-10) → • B (8-9) → • C (7-8) → • D (6-7) → • F (< 6) → • does not turn in →	
S2	82%	• A (9-10) → • B (8-9) → • C (7-8) → • D (6-7) → • F (< 6) → • does not turn in →	

Grading Scale:



A Case Study in Optimization: T.A.C.O.

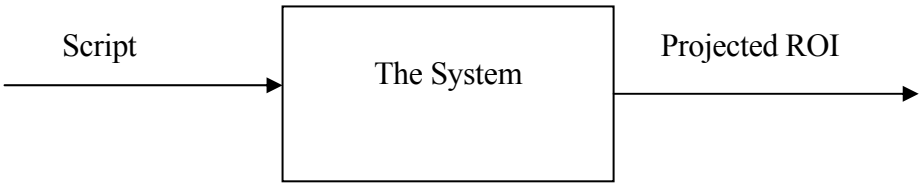


Data Mining

Automated discovery of patterns in large transaction-based data sets and transforming them into an understandable structure for further use

Computer Models in Hollywood

http://zimmer.csufresno.edu/~sasanr/Teaching-Material/MIS/DSS/computer-models-in-hollywood.pdf

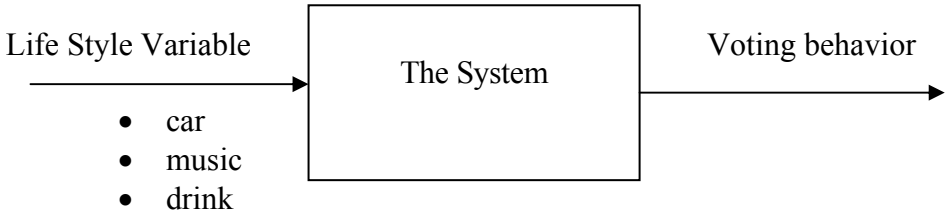


The Verdict:

Decision Process	ROI
Traditional approach	-24.4%
Random selection	-18.6%
DSS model	+5.1%

Mining Consumer Data in Politics

http://zimmer.csufresno.edu/~sasanr/Teaching-Material/MIS/DSS/mining-consumer-data-in-politics.pdf



Drug Industry Mines Physicians' Data to Boost Sales

Listen to it

Read it

http://zimmer.csufresno.edu/~sasanr/Teaching-Material/MIS/DSS/Drug%20Industry%20Mines%20Physicians.pdf