X. Business Rules

Business Rules
Structured English
Decision Tables
Decision Trees

Information Systems Analysis and Design   CSC340

Business Rules

Business rules are used to describe the properties of an application, e.g., the fact that an employee cannot earn more than his or her manager, or that every employee has a unique employee number.

A business rule can be:

- An integrity constraint on the data of the application, e.g., "each employee earns less than her manager".
- A derivation rule, whereby information can be derived from other information, e.g., "the price of a train ticket, in Canadian dollars, is given by the distance to be travelled in kilometers, multiplied by 0.2, multiplied by 1.5 for a first class ticket".

Examples of Business Rules

Constraints
(BR1) The manager of a department must belong to that department.
(BR2) An employee cannot earn more than her manager.
(BR3) A department of the Toronto office can only be managed by an employee who has ≥ 10yrs experience.
(BR4) An employee can only participate in projects associated with her department.

Derivations
(BR5) The budget of a project is the sum of all salaries of participating employees, multiplied by 3.

Specifying Business Rules

How do we specify business rules? We'll be looking at several alternative notations.

- Natural Language -- use unrestricted natural language...but such descriptions can be highly ambiguous
- Structured English -- use a subset of a natural language (both syntactically and vocabulary-wise) to minimize ambiguities...this has been used with some success
- Decision Tables -- use a table representation of alternative outcomes (similar to truth tables)
- Decision Trees -- use a tree representation of alternative outcomes

We need representations that are understandable by end user

Structured English

Looks a lot like pseudocode:

For each LOAN ACCOUNT NUMBER in the LOAN ACCOUNT FILE do the following steps:
If the AMOUNT PAST DUE is greater than $0.00 then
while there are LOAN ACCOUNT NUMBERS for the CUSTOMER NAME do the following:
sum the OUTSTANDING LOAN BALANCES
sum the MINIMAL PAYMENTS
sum the PAST DUE AMOUNTS
report the CUSTOMER NAME, LOAN ACCOUNT on OVERDUE CUSTOMER, LOAN ANALYSIS

Another Example

- do while there are more staff in the list
  - calculate staff bonus
  - store bonus amount
  - begin case
  - case bonus > £250
    - add name to StarOfTheMonth list
  - case bonus < £25
  - print warning letter
  - end case
  - end do

Takes some effort to specify, not very readable... too close to an implementation
Some Rules for Structured English

- Use only nouns and terms defined in the project dictionary.
- Avoid compound sentences because they can be highly ambiguous.
- Avoid undefined adjectives and adverbs (such as “good”, “nice” etc.) unless clearly defined in the dictionary in terms of value ranges (e.g., “good” ↔ 65-75%).
- Avoid language that destroys the natural flow of control within the process (i.e., goto’s).
- Use a limited set of flow constructs, such as sequencing, if-then-else, while do etc.

Decision Tables

- If there are \( n \) parameters (or, conditions) to a decision, each of which can take \( k_1, k_2, \ldots, k_n \) values, then make up a table with \( k_1 \times k_2 \times \ldots \times k_n \) columns and as many rows as there are possible actions (or, outcomes).
- For example:
  - If the plane is more than half full and the flight costs more than $350 per seat, serve free cocktails; unless it is a domestic flight. Charge for cocktails in all domestic flights where cocktails are served, i.e., those that are more than half full.

How to Construct Decision Tables

1. Identify all conditions and all outcomes.
2. Create the decision table, with one column for each possible combination of condition values and one row for every possible outcome.
3. Fill in the table.
4. Eliminate ambiguities, uncover cases, contradictions, redundancy.

Going to a Place

- In town?
- Short distance?
- Good weather?
- Can afford?

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<th>Y</th>
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<tbody>
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<td>Take train!</td>
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Another Example

- Is budget likely to be overspent?
- Is overspent likely to be over 2%?
- No action!
- Write letter!
- Set up meeting!

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**Decision Trees**

- Nodes of a decision tree represent partial outcomes, successors of a node represent mutually exclusive alternatives, leaves of a decision tree represent outcomes.

**Decision Trees: An Example**

Note: This is a real example (…):

"Air shipping charges are set depending on the weight of a parcel. The basic rate is $3/lb, reducing to $2/lb for excess over 20 lb, with a minimum of $6. Surface freight is $2/lb for express delivery. However, this rate only applies in the local delivery area. If the shipping address is outside the local area and the parcel weighs more than 20lb, or express delivery is not required, the surface rate is the same as for local delivery (express). Normal delivery of packages is $2/lb up to 20lb is $2/lb, with $1 express surcharge (per pound).

Notwithstanding the provisions of the previous paragraph, air freight to destinations west of the Mississippi is charged at double rate."

**Clarifications**

- **Question:** Is there a difference between freight shipping and handling?
- **Answer:** No, all rates include freight and handling.

- **Question:** The description mentions "up to 20lbs" and "over 20 lbs". Which rate applies for exactly 20lbs?
- **Answer:** It's generally understood that "up to 20lbs" means "up to and including 20lbs". We can't spell out every little thing, you know?

- **Question:** The fourth sentence could be read in two ways: "both outside the local area and also over 20lbs, or, alternatively, express not required" or "outside the local area and, in addition, either over 20lbs or express not required". Which is correct?
- **Answer:** The second one. The first meaning couldn't be right because you would end up charging the local express rate when express delivery was not required. I see your point though, it is a bit confusing...

**The Freight Decision Tree**

- **Area**
  - East of Miss.
  - West of Miss.
- **Weight**
  - ≤20lbs
  - >20lbs
- **Method**
  - Air
  - Surface
- **Destination**
  - Local area
  - Outside local area
- **Service**
  - Normal
  - Express
- **Price**
  - $3/lb
  - $2/lb

**Summary**

- **Decision trees** are best used with applications involving up to 15-20 outcomes.
- **Decision tables** are more appropriate for problems involving complex combinations of up to 5-6 conditions (but can handle much larger number of outcomes).
- **Structured English** (and state-oriented models) are most appropriate for problems involving sequential considerations of alternative steps.

**Additional Readings**