AIMMS
advanced modeling capabilities

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AIMMS in a Nutshell

• **AIMMS is an integrated modeling system**
  - modeling language, integrated GUI, direct access to commercial and personal solvers, advanced deployment options, and extensive development support features

• **AIMMS supports the complete optimization chain**
  - from prototyping to large-scale deployment
  - from development to operational use
  - from single user to (shared) web use

• **AIMMS purpose is not to impose restrictions on the architecture, but to adapt to it**
AMMS Focal Points for Development

Language

AIMMS

Object oriented language (re-use and share); proper diagnostic tools; extended interfacing (internal and external); data driven
Need for access to (most) solver/problem types; customizable and advanced solution techniques; distributed processing; parallel execution; etc.
AMMS Focal Points for Development

- Language
- Graphical User Interface (GUI)
- Algorithmic Capabilities

**AIMMS**

Essential during development and for stand-alone applications; interactive with language; reduces development time
AMMS Focal Points for Development

- **Language**
- **Graphical User Interface (GUI)**
- **Algorithmic Capabilities**
- **Deployment Capabilities**

Usage from single-user to client/server architecture; usage in SOA; interfacing; multi-platform deployment
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Graphical User Interface (GUI)

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Deployment Capabilities

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AMMS Beneficiaries

- Developers
- IT
- End Users
- Management
AIMMS Modeling System
• Procedures & definitions

(Some) AIMMS Highlights

Procedures & definitions

```
Procedure SolveCuttingStockModelUsingLp;
Arguments StockModel, StockIndex, CuttingPatterns, MaxGeneratedPatterns, MaxPatterns, ShadowPriceOfNewPattern;
Result ShadowPrice;
Body

CreateInitialPatterns:

/* Solve the related LP and generate new patterns until no improved patterns can be found anymore */
repeat
  solve CuttingStockModel where type := lqp;
  solve PatternGenerationModel;
  break when ShadowPriceOfNewPattern <= 1 + ZeroTolerance;
  MaxGeneratedPatterns += 1;
  CuttingPatterns += MaxGeneratedPatterns;
  FinalPatterns += FinalPatterns + MaxGeneratedPatterns;
endrepeat;

/* Finally solve the full MIP model with the objective function only assuming does not discover this fact itself */
/* solve CuttingStockModel where MIP should CountPatterns(RealSize, FinalSize, FinalPattern)
VisualizePatterns;
```

ShadowPriceOfNewPattern

<table>
<thead>
<tr>
<th>Type</th>
<th>Variable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifier</td>
<td>ShadowPriceOfNewPattern</td>
</tr>
</tbody>
</table>

Index domain

Text

Range

Unit

Default

Property

Newvar status

Definition

```
sun(f, MeetFinalDemand.ShadowPrice(f) * FinalsInNewPattern(f))
```

Comment
(Some) AIMMS Highlights

- Procedures & definitions
- Global & local compilation
(Some) AIMMS Highlights

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- Global & local compilation
- Point & Click / Drag & Drop IDE

![AIMMS Interface Screenshot]
• Procedures & definitions
• Global & local compilation
• Point & Click / Drag & Drop IDE
• Advanced diagnostic & development tools: editor, debugger, profiler, MP Inspector

(Some) AIMMS Highlights
• Procedures & definitions
• Global & local compilation
• Point & Click / Drag & Drop IDE
• Advanced diagnostic & development tools: editor, debugger, profiler, MP Inspector
• Modeling of time constructs
Procedures & definitions
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Modeling of time constructs
Data management & batch run options
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- Broad class of solvers with update & call-back functionality

![Solver configuration](image)
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- … much … much … more
Parallel Solver Sessions (Oct '06)

- **Standard**
  
  ```
  solve xdice;
  solve opit;
  ```

- **Synchronous vs. Asynchronous**

  ```
  gmp_dice := GMP::Instance::Generate( xdice );
  session_dice := GMP::Instance::CreateSolverSession( gmp_dice,
      Solver: 'CPLEX 10.1' );
  
  gmp_opit := GMP::Instance::Generate( opit );
  session_opit := GMP::Instance::CreateSolverSession( gmp_opit,
      Solver: 'CPLEX 10.1' );
  
  GMP::SolverSession::Execute( session_dice );
  GMP::SolverSession::Execute( session_opit );
  
  GMP::Solution::RetrieveFromSolverSession( session_dice, 1 );
  GMP::Solution::RetrieveFromSolverSession( session_opit, 1 );
  ```
• Stochastic LP/MIP recourse model is generated based upon any given deterministic model
• No need to reformulate the deterministic model
• Just:
  – Create additional attributes for selected parameters and variables
  – Create scenario tree w/ probabilities (user adaptable templates are available)
  – Provide stochastic input data
Stochastic Programming Support (Oct '06)

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- No need to reformulate the deterministic model
- Just:
  - Create additional attributes for selected parameters and variables
  - Create scenario tree w/ probabilities (user adaptable templates are available)
  - Provide stochastic input data
- Next:
  - AIMMS will generate and solve the corresponding deterministic equivalent
**Intention:** Provide a dynamic, customizable, flexible table for End Users
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Some features:

• **Artificial indices**
**Pivot Table (Oct 05 + Oct 06)**

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Some features:
- Artificial indices
- Sorting leaf nodes based on grid values
- Rearranging nodes by drag-and-drop
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Some features:
- Artificial indices
- Sorting leaf nodes based on grid values
- Rearranging nodes by drag-and-drop
- Suffix Index
- Unit Display
- Grand total
- Geographical map image for existing network object (via GIS server)
- Coordinates of AIMMS nodes are superimposed on map
GIS Link (Oct 06)

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- Automatically updated: zooms or scrolls
- Ordered sequence of layers create final map
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• Currently supports:
  – WMS servers
    (Web Map Service)
  – WFS servers
    (Web Feature Service)
  – local GML files
    (Geographical Markup Language)
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• Control from within AIMMS
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- Control from within AIMMS
AIMMS Demo - Pooling

Parallel Solver Sessions
Pivot Table
Case comparison
Diagnostic Tools
Possible next steps

- If you are an AIMMS user:
  - Download AIMMS (v3.7) at www.aimms.com

- If you are new to AIMMS:
  - Request a free trial license at www.aimms.com
  - Download AIMMS
  - Start with our ‘Tutorial for Beginners’
AIMMS Demo - Pooling

Parallel Solver Sessions
Pivot Table
Case comparison
(Diagnostic Tools)