Institute of Systems Science
National University of Singapore

GRADUATE CERTIFICATE
INTELLIGENT REASONING SYSTEMS

Workshop Project (Continuous Assessment)

Subject: *Machine Reasoning*

Agenda : Course Assessment & Grading

"PASS" >= 50 marks

- **Paper Assessment** on last lecture day
  - [**Individual** 50 marks] 1 hour open book exam
- **Workshop Project Deliverables** due last lecture day + 14
  - [**Individual** 10 marks] An example reasoning system enhanced by knowledge discovery technique, e.g. home loan approval
  - [**Group** 15 marks] A runnable standalone bespoke business reasoning system
  - [**Group** 15 marks] A project report with relevant attachments, including
    - System Design / Knowledge Models
    - System Development & Implementation in tools, e.g. KIE suite
    - System User Guide
  - [**Group** 10 marks] A 5 minute video presentation, covering
    - System Design & Use Case Demo

For workshop project, conduct researching reading and make your own reasonable assumptions where applicable.

Reference:
Housing & Development Board Build-To-Order Recommender
https://github.com/telescopeuser/bto-recommender-system

JBoss KIE: Knowledge Is Everything
http://www.kiegroup.org/

WORKSHOP PROJECT CANDIDATE ONE

Airport Gate Assignment System (AGAS)

Faced with intense competition from major airports in the region, ***The Best Airport (TBA)*** needs to enhance the quality and efficiency of its airport services so that planes can have a faster turn-around. This improved throughput will definitely make its customers (the airlines) happy and to be firmly rooted to TBA. With some 5,000 flight arrivals each week, the assignment of aerobridges (or simply "gates") is becoming increasingly complex and time consuming. Efficiency in gates assignment is crucial for TBA to remain as the airport of choice for all major airlines. You are a TBASU (TBA Strategic Unit) project specialist who is tasked to work on this important assignment.

The following is a transcript from your interview with Mr. Lim, the domain expert in gates scheduling:

You: Mr. Lim, what is the first step in the assignment of a gate to an incoming flight?

Mr. Lim: Well, flight information sends me a schedule of all incoming and outgoing flights for a particular day, at least 24 hours in advance for me to assign gates and service units to all flights. My first step is to prioritize all the flights, according to type - international or domestic, number of passengers and refueling needs. The number of passengers and refueling needs will determine how much time is needed, and thus how long the gate will be occupied. Another constraint is the amount of time before the plane has to depart. The top priority flight will be taken care of first. My job is to match a gate to an incoming flight for disembarkation of passengers and providing services for the aircraft.

You: Is there a systematic procedure that you use for gate assignment?

Mr. Lim: I 'm not sure what you mean by systematic, but what I do is, I determine the services required by an aircraft, and assign a service unit (SU) which is able to provide those services, to a gate. Obviously, both the SU and the gate must be free or available. I get this information from the Gates Operation System which is updated in real-time. But this assignment is not as simple as it sounds. Each gate has a max passenger handling capacity, so we need to know the number of passengers coming in. A gate is also reserved for either domestic or international flights. A gate is also limited by its capability of supporting the required services.

You: Could you clarify this further with an example?

Mr. Lim: OK, suppose that an aircraft needs catering and cleaning. Then we must look for a gate that is capable of supporting those 2 services. However, we also try to minimize wastage, in the sense that we do not want to assign a gate which is capable of supporting all 3 services, when only 2 are needed. We should try to save that gate for the time when all 3 services are needed.

You: Let me recap: An SU can provide one or more services, like cleaning, catering and refueling depending on the needs of the aircraft. And the gate must be able to support the chosen SU.

Mr. Lim: Correct.

You: So you are assigning SUs to a gate, and a gate to an aircraft?

Mr. Lim: You got it!

You: Do all aircraft need the same services?

Mr. Lim: No. But if a particular service is needed, then it is mandatory that a gate providing that service is assigned to the aircraft.

You: Can you give me an example?

Mr. Lim: Certainly. Suppose that cleaning, refueling and catering are needed. The ideal situation would be to assign SU-101, for example, which provides all 3 services. But suppose SU-101 is not available, then we need to look for free SU, say SU-104 which provides catering and cleaning, and SU-105 which provides refueling and cleaning. SU-104 would be assigned to provide the catering and cleaning, but refueling can come from SU-105. In this case there is a redundancy, which cannot be avoided. An SU can only be assigned to one flight and hence one gate only at any one time.

You: How do you find out what services are required by an incoming flight?

Mr. Lim: Cleaning is always needed. Refueling is determined by the remaining fuel level, and catering of meals depends on the duration of the next outgoing flight.

You: And how do you compute how much fuel the aircraft needs for the flight out?

Mr. Lim: We have a set of tables (pointing to the laminated papers) to refer to. We also use the tables to determine catering needs as well as to do the prioritization of flights that I mentioned earlier.

You: I think I've taken too much of your time. Can I come back to you tomorrow to verify my understanding of what we discussed today? Thank you, Mr. Lim.

[End of Interview]

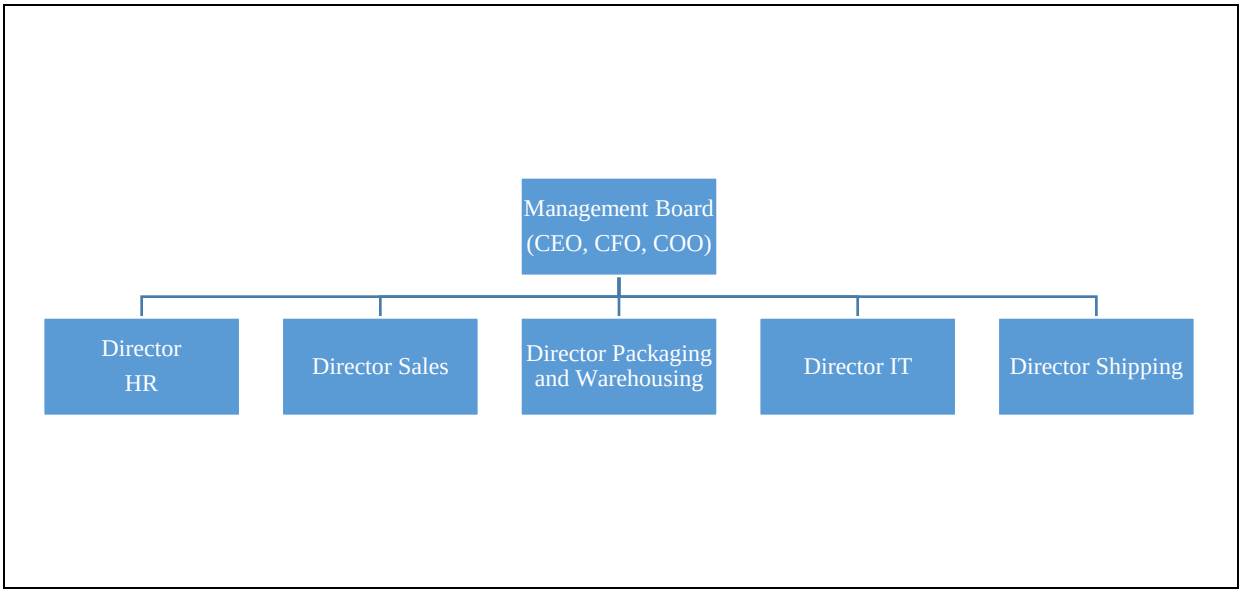
WORKSHOP PROJECT CANDIDATE TWO

DoReMi Books Inc.

1. Background

DoReMi Books is a company that specializes in the supply and sale of classical music scores and music books in the USA with subsidiaries in the major cities of each of the 50 states. An important line of business for the company is the supply of music books to music schools. These schools buy books in bulk for their students and are given special bulk-package discounts. Sales to music schools constitute 30% of the annual revenue of ***DoReMi***.

The organization structure of the company is shown below.



2. Business Process & Improvement

As the company started in 1955 (and is now 57 years old), some of its business processes are manual and rather traditional. The company is now facing strong competition from its competitors (both new and old), who have embraced online and internet sales as the new way of interacting and transacting with their customers.

In response to the new challenges brought on by online sales transactions, the Chief Executive Officer (CEO), Peter Lee, asked a consultant to conduct a business process improvement exercise to revamp their music books sale transaction and order handling process as well as introduce improved stock and inventory planning and management capabilities. One of the key outcomes of this exercise was a new order handling process and the introduction of an internet sales transaction system, including an advanced business intelligence module for optimal stock inventory and warehousing forecasting.

After a period of process analysis and redesign, a new streamline process for online purchase from individual customers were defined. For bulk purchase, an automated workflow with automated inventory checks and approval was also established that can simplify the sales orders from music schools ordering in bulk. The process for handling orders from this client segment is simpler to implement as they have standard needs and also credit facilities already well established with ***DoReMi***. The company is now ready to implement the new process and system.

3. Planning Implementation and Rollout

In considering the plans for the implementation and rollout of the new process and system, the CEO asked all his department heads (Directors) to gather some informal feedback on this major business process change initiative. The following feedback was shared in the weekly management board meeting:

HR Director:	I am sensing some discomfort among the staff. The union has also mentioned about some talk of a rumour going around that the company is going on a down-sizing exercise and people will be made redundant once the new process and system is operationalised. This revamp thing that we are planning needs to be handled with care. I am hearing of head-hunters enquiring about our top-performing sales people.
Director Sales:	I am not aware about the rumour. But in my informal checks with my team leaders, some are asking why are we doing this? We are in the music books industry, and as you know, this is a rather niche area, with our product being mainly in the classical genre and highly specialized stuff. Why should we be bothered with this online talk? Our customers are likely to be in the adult age-group and would not be keen in online transactions anyway.
Director Packaging and Warehousing:	A high proportion of our workers in my department are of the older generations and they are also some of our most loyal and experienced workers. As you know, we do need some classical music background knowledge in our business. The new IT-enable process and business intelligent system may pose a technology challenge to my people. There is worry that the high-tech stuff will actually slow them down.
Director IT:	We have a lean team in our IT department and it is a constant struggle to keep up with the demands and expectations of the business units across the various geographically dispersed subsidiaries. Any introduction of new large IT systems will need to be carefully planned as it may cause a degradation of the IT support service. On a more positive note, the IT staff members are actually looking forward to learning and working with new tools and technologies. They are asking how they can find out more on process improvement and redesign concepts and methodologies.

4. DoReMi Books Order Handling Process

1. The customer service representative receives a call from the customer.
2. Determine if the customer has an existing account.

   2.1. If the customer has an existing account:

      2.1.1. Record the account number.
      2.1.2. Record the order information.
      2.1.3. If the order is not within the auto-approval limit, send the order to Account Department for review. Otherwise, approve the order.

   2.2. If the customer does not have an account:

      2.2.1. Record customer information.
      2.2.2. Assign account number.
      2.2.3. Record order information.
      2.2.4. If the order is not within the auto-approval limit, send the order to Account Department for review. Otherwise, approve the order.

3. If the order is auto-approved, the followings activities are performed in sequential order.

   3.1. Send the order information to the packaging department in warehouse.
   3.2. Packaging department packages the goods.
   3.3. Packaging department arranges for delivery.
   3.4. Packaging department informs the customer service representative.

4. If the order is sent for review:

   4.1. Account Department reviews the order manually.
   4.2. Determine if the order is an acceptable credit risk.

      4.2.1. If the order is an acceptable credit risk:
         4.2.1.1. Send the order information to the packaging department in warehouse.
         4.2.1.2. Packaging department packages the goods.
         4.2.1.3. Packaging department arranges for delivery.
         4.2.1.4. Packaging department informs the customer service representative.

      4.2.2.If the order is not an acceptable credit risk:

         4.2.2.1. Account Department cancels the order.
         4.2.2.2. Notify the customer about the cancellation through the customer service representative.

5. Business Issues to Be Considered in System Design

A.	***DoReMi*** have an existing logistics application system but the users are not sure of the details of the process it carries out. This is because the logistics system is a ***black box*** since there is no documentation and the original IT/user project managers have left the company.
B.	There are many common tasks across the different departments in ***DoReMi***. For example, there are common tasks to collect customer particulars, to collect their orders, to check their credit worthiness etc. Currently, the different departments in ***DoReMi*** do not always carry out these tasks in the same manner. ***DoReMi*** management would like to standardise and streamline these tasks so that they are carried out in the most productive way.
C.	***DoReMi*** have many HR internal forms that need to be automated. Some have simple processes, e.g. fill in by applicant, and review by his supervisor and approval by the supervisor's manager. Others were more complicated, e.g. fill in by applicant, and then route to different approving persons depending on the dollar amount.
D.	***DoReMi*** is thinking of implementing a ***Print-On-Demand*** business process for the school bulk ordering of music scores (e.g. for music band use). This new business process will not need to keep an inventory of music scores. Instead, the Print-on-Demand process will perform high-volume in-house printing of the music scores as and when orders come in. This will help reduce warehouse storage space and costs.
E.	Many of the ***DoReMi*** managers gave the requirement that they wanted a tool that could help them with delegation of tasks and tracking of the task status for the various small projects that they need to manage.
F.	For music books, ***DoReMi*** purchases books from many different publishers. The processing of the publisher's invoices currently takes a lot of manual effort and ***DoReMi*** management is hoping to automate this process.
G.	There are many sales promotions (such as Christmas Sale, New Year Sale etc.) and the price of the books can change often depending on many factors. The IT department currently takes too long to make the changes to the system to cater for the frequent price changes.
H.	During peak hours, the cashier is not able to cope with the large number of customers as each payment takes some time (eg: credit card slip printing and signing) and this adds up when there are many customers.

WORKSHOP PROJECT CANDIDATE THREE

Housing & Development Board Build-To-Order Recommender

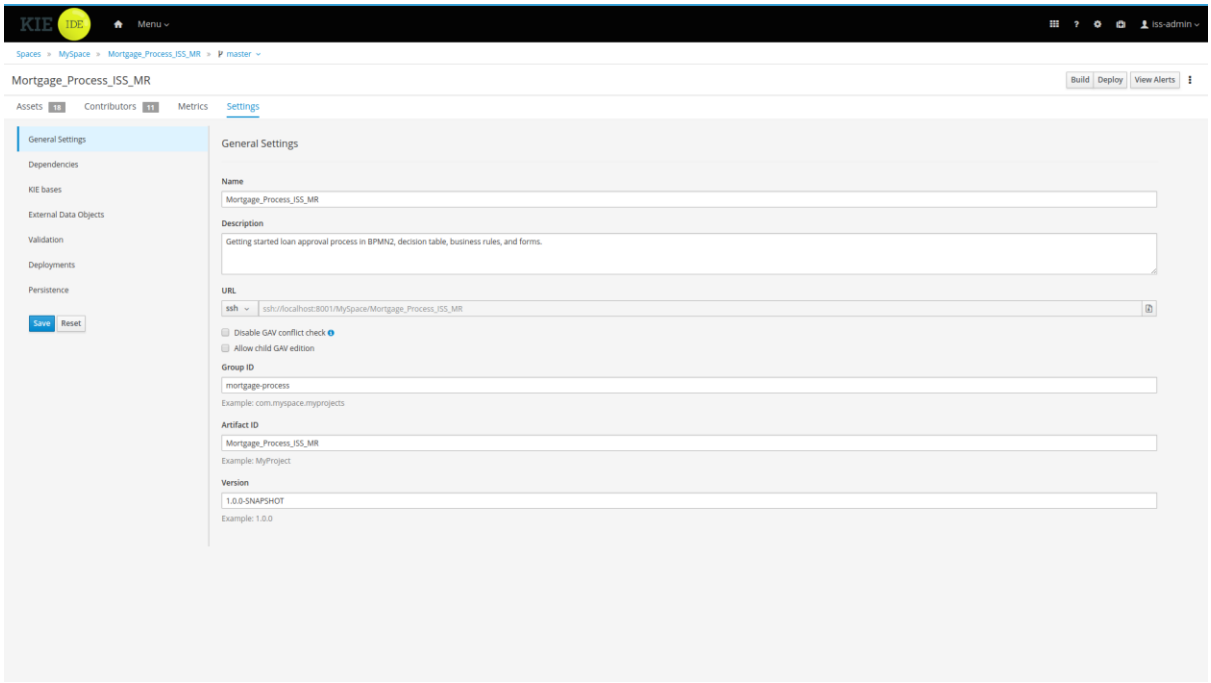
Convert and implement HDB BTO system using KIE product suite, e.g. Drools, jBPM, user interfaces, and other relevant programming modules.
https://github.com/telescopeuser/bto-recommender-system

WORKSHOP PROJECT SUBMISSION

Project Export & Import using KIE Workbench

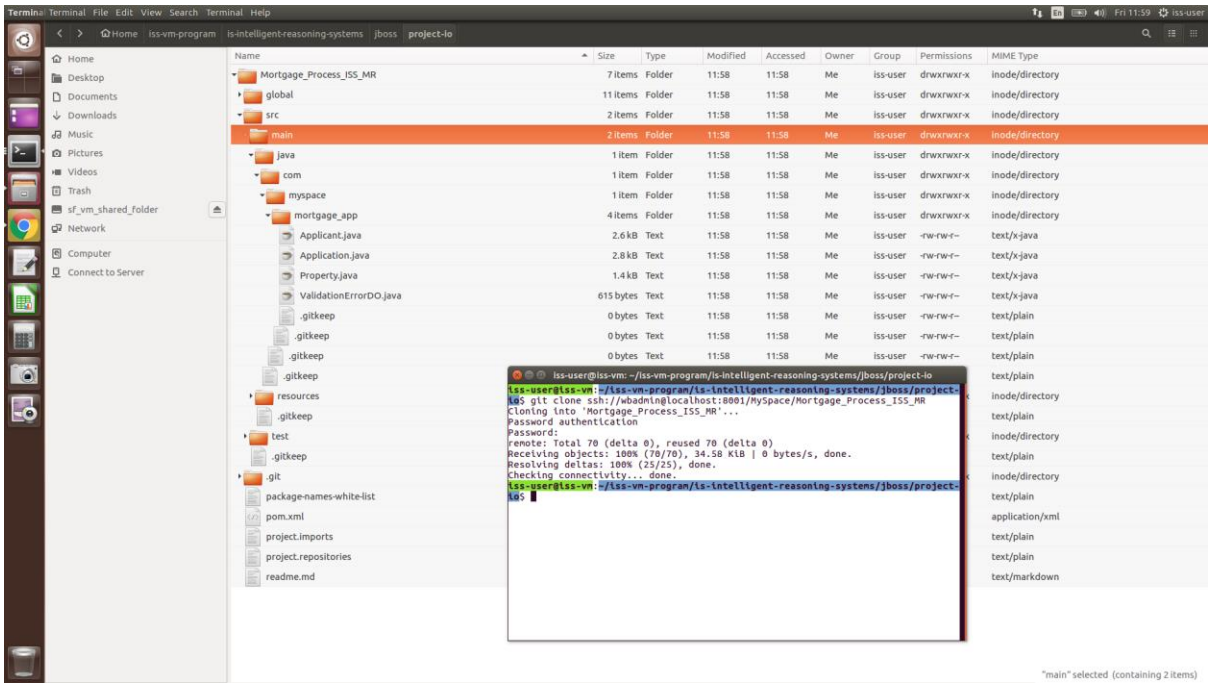
Example: export KIE project ***Mortgage_Process_ISS_MR*** from work space ***MySpace***

Review project settings for ***MySpace/Mortgage_Process_ISS_MR***



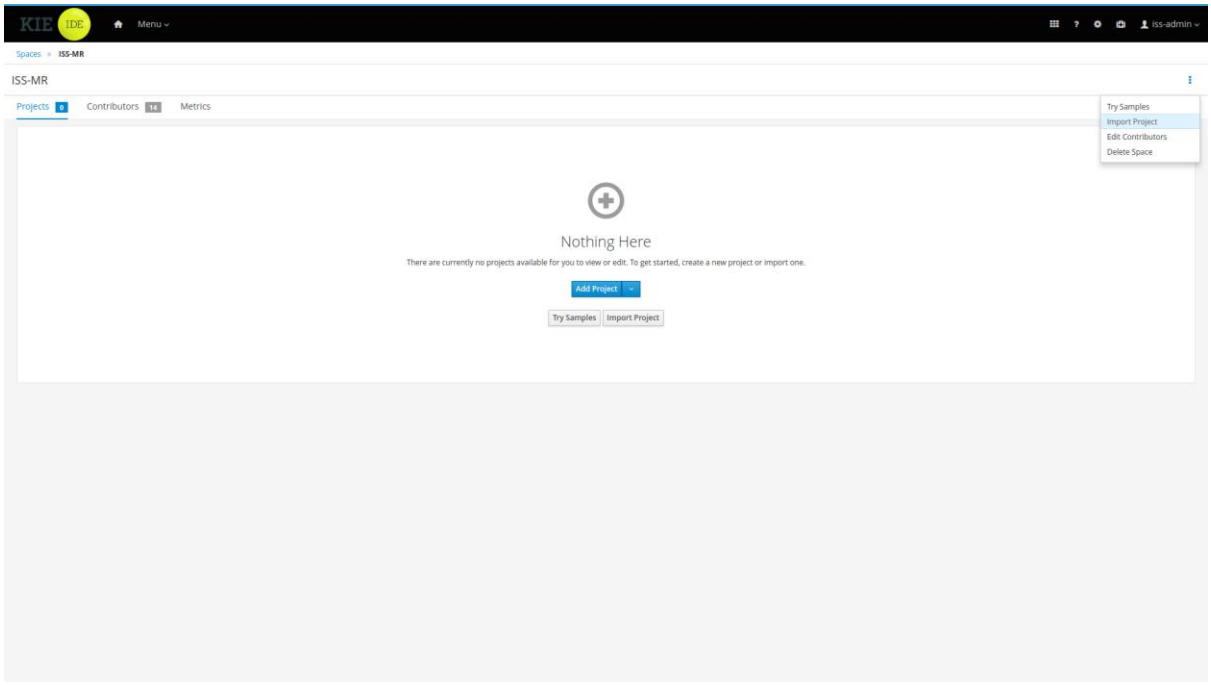
Export project from KIE Workbench

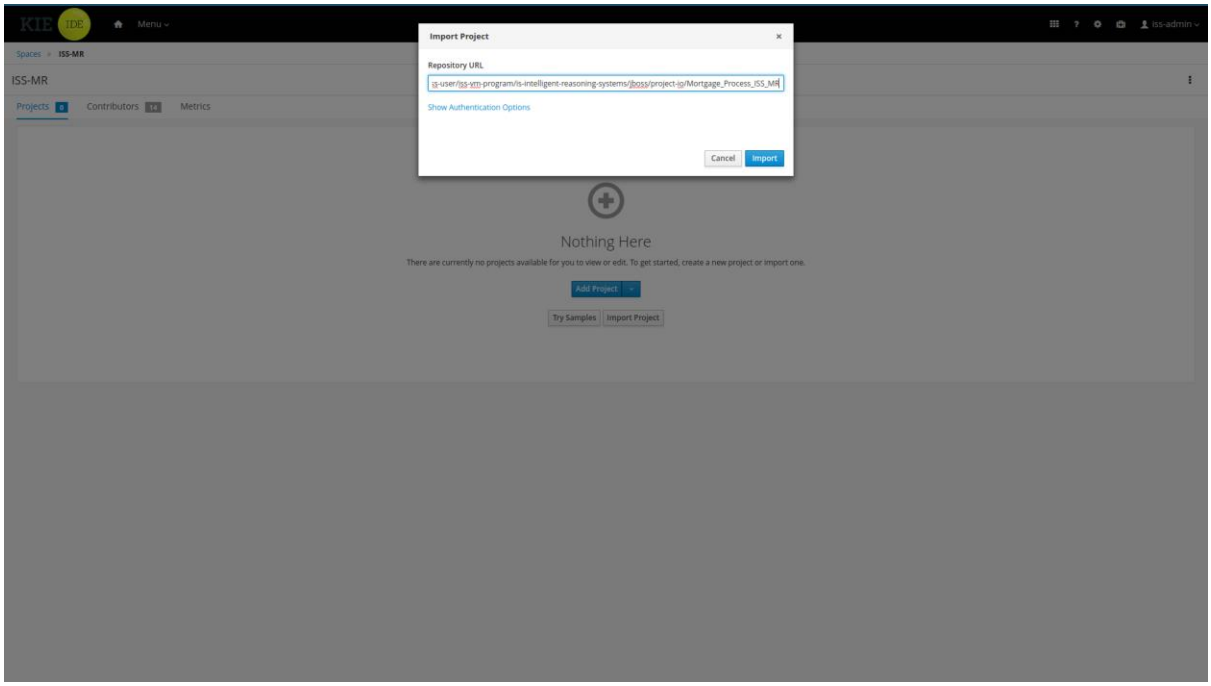
1. Select a folder for exporting, example here uses */home/iss-user/iss-vm-program/is-intelligent-reasoning-systems/jboss/project-io*
2. Start a Terminal there, key in command *git clone ssh://wbadmin@localhost:8001/MySpace/Mortgage_Process_ISS_MR*
3. Key in password '*wbadmin*' for user wbadmin

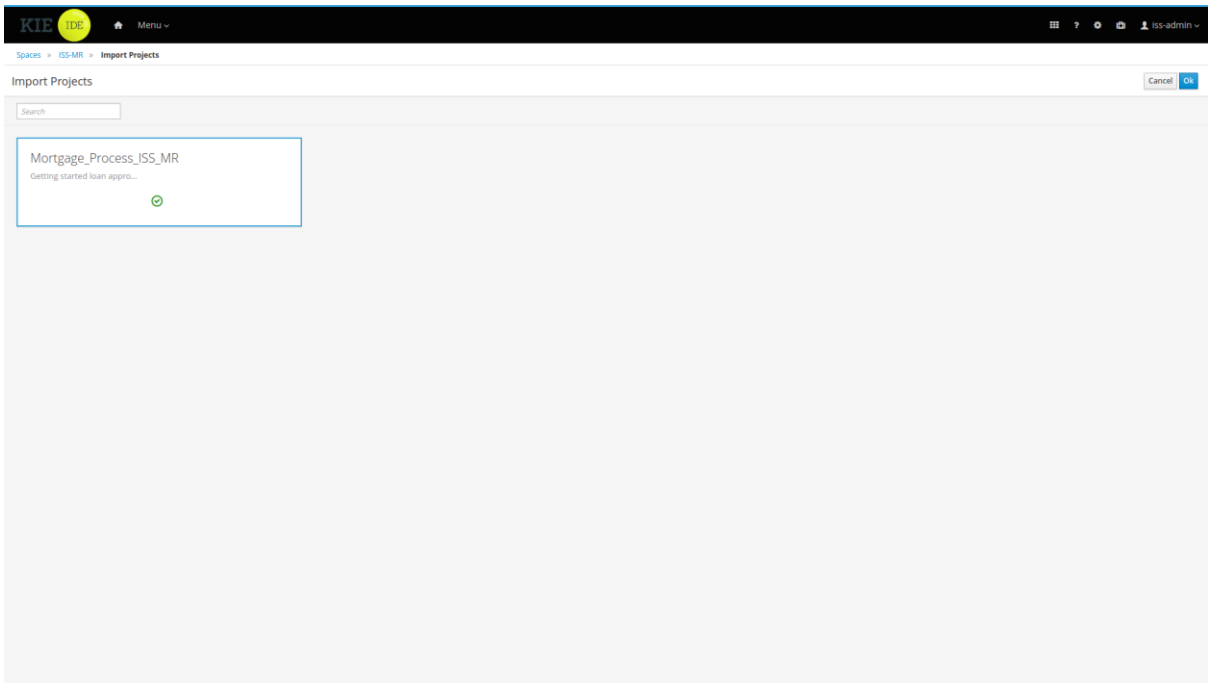


Import project into KIE Workbench

1. In KIE workbench, select/create a project Space, example here uses ***ISS-MR***
2. Click menu function '***Import Project***'
3. Key in ***file:///home/iss-user/iss-vm-program/is-intelligent-reasoning-systems/jboss/project-io/Mortgage_Process_ISS_MR***



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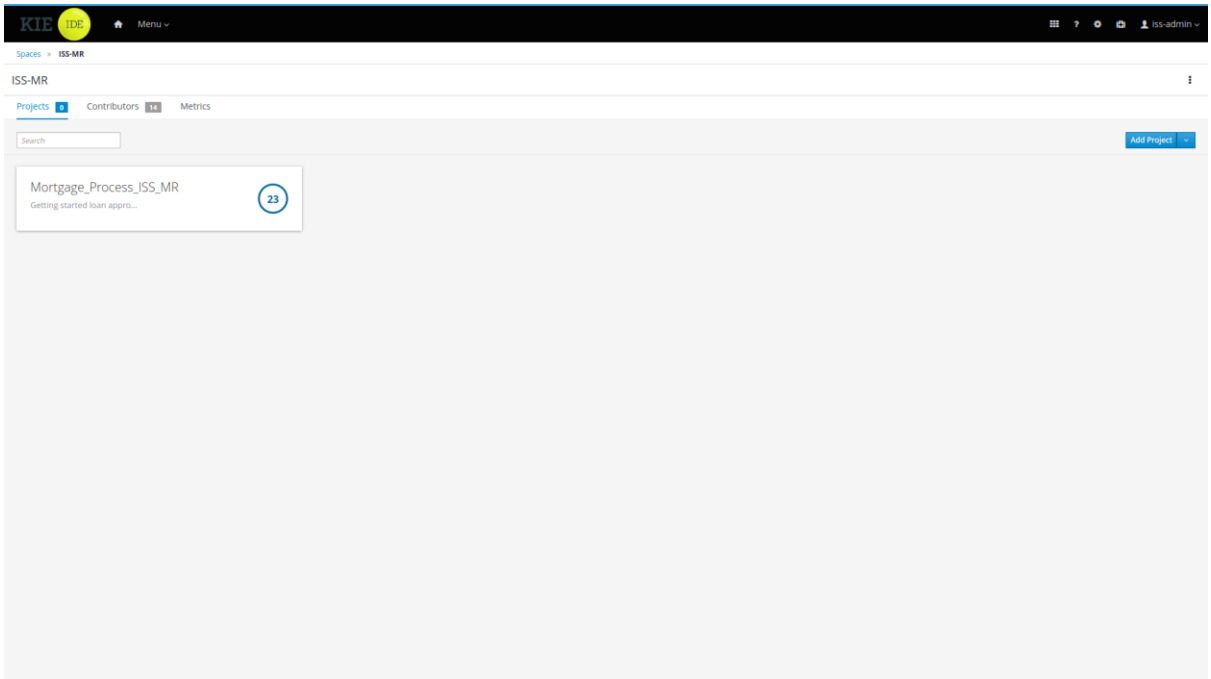
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Getting started loan appro...
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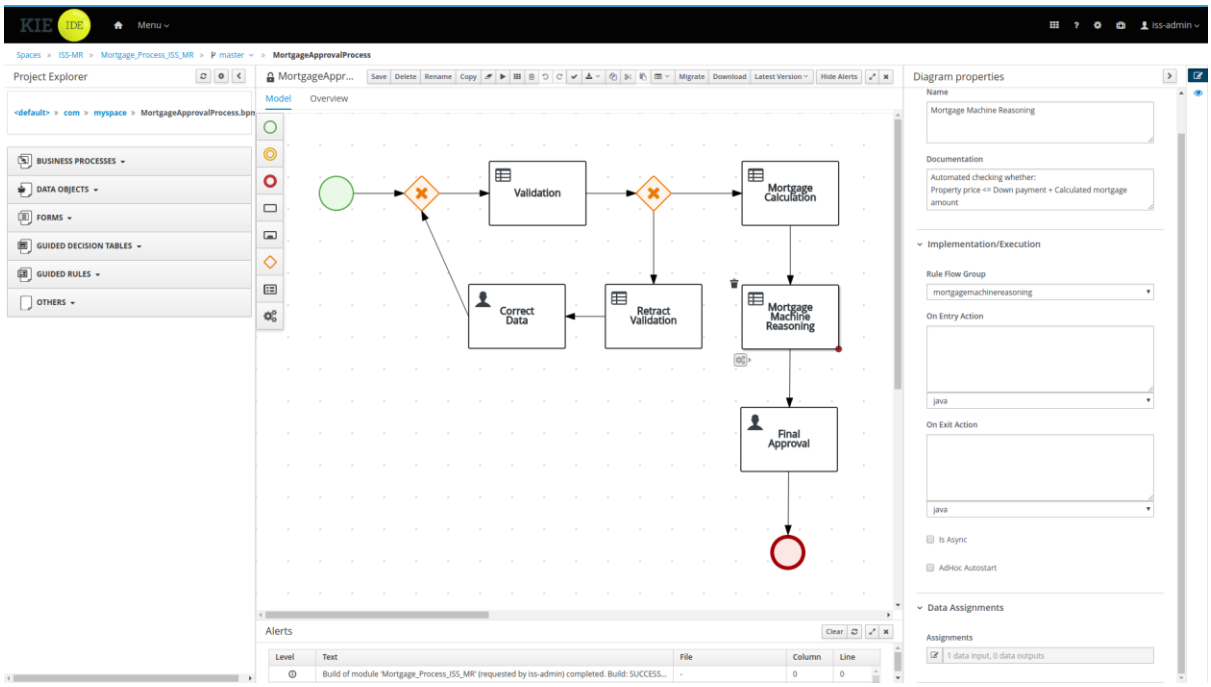

Reference
https://developer.jboss.org/thread/269991
https://developer.jboss.org/thread/237411
https://developer.jboss.org/thread/252588

Caveats

Besides exported project code submission, compose <Installation Procedure> in your <System User Guide>, for lecturer to successfully re-run & evaluate, e.g. necessary bespoke user creation for your project.