
6SENG001W Reasoning about Programs

Tutorial 1. Exercises using the B Tools Atelier B & ProB

B-Method Tools: Atelier B & ProB

The first lab session is intended to introduce you to the B tools **Atelier B** & **ProB** and to B's *Abstract Machine Notation (AMN)*.

You will be required to type in the *PaperRound* abstract machine into **Atelier B**.

Next you should **syntax & type check** it using **Atelier B** & finally **animate** it using **ProB**.

You should refer to the tool's manuals.

Accessing B Tools

Atelier B & **ProB** are installed on the University's Windows PCs, they are accessible from the **AppsAnywhere** application.

Exercise 1.1

Setting up & using the **Atelier B** tool & creating a "*workspace*".

1. Start the **Atelier B** tool from the **AppsAnywhere** application.
 2. Start by creating a "*workspace*" for all your B specification projects.
 - Using Window's Explorer create a directory/folder in your **H:** *Home Drive* directory to be used as your B specification "*workspace*".
 - Next, create the "*workspace*" from the **Atelier B** "*Atelier B > New > Workspace*" menu.
 - Use the "*Browse*" option to select the directory/folder you just created on your **H:** drive.
 3. Next set the "*Default Project Directory*" (place where B specification projects are created) to be the "*workspace*" you have just created.
 - Set the "*Default Project Directory*" from the **Atelier B** "*Atelier B > Preferences*" menu.
 - Select the "*Project*" tab, then use the "*Browse*" option to select the same "*workspace*" directory/folder you just created on your **H:** drive.
 - Finally, select "*Software Development*"
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Exercise 1.2

Create a "*Project*" for your new B specification, i.e. *PaperRound*.

1. Do this from the **Atelier B** "*Atelier B > New > Project*" menu.

Type in a "*Project Name*"

Select "Project Type" as "*Software Development*".

2. Then add components to your B specification, i.e. a *B MACHINE* that makes up the system specification.

Do this from the **Atelier B** "*Atelier B > New > Component*" menu.

Type in a new component name, in this case it should be just *PaperRound*, you do not need to type in the ".mch".

3. If everything has worked correctly you should see an *orange box with "PaperRound"* in it.
4. To begin typing the *PaperRound* specification in just "*double-click*" the "*orange PaperRound*" box.

Exercise 1.3

Using the **Atelier B** built in editor, to type in the [PaperRound specification](#).

You should create it in a file called

`PaperRound.mch`.

You will need to convert the B symbols into their ASCII equivalent, see the first lecture & the online symbols list.

Exercise 1.4

Syntax & Type Checking the specification , using the **Atelier B** tool.

You can either syntax & type check the *PaperRound* specification as you type it in or after you have finished typing it in.

The **Atelier B** tool will type check it automatically immediately after you have saved any changes.

Error messages will be displayed in the "Outline" sub-window & underlined in red in the specification.

Alternatively, you can "force" type checking by either:

- pressing the *blue circular "Tc" button* at the top of the tool's main screen.
- pressing Control-T, i.e. hold down the "Ctrl" (Control) key & at the same time press the "T" key.

Exercise 1.5

Once the *PaperRound* machine has been syntax & type checked & there are **no errors**, you can *animate* it using the **ProB** animator.

*** SEE THE ONLINE - [Tutorial First Step](#) ***

1. To do this start the **ProB** animator tool from the **AppsAnywhere** application.

2. Then *open* the `PaperRound.mch` file you created in **Atelier B**.

You can open the `PaperRound.mch` file from the "*File > Open*" menu, by using the "*Browse*" option.

3. If there are **no errors** then you should see:

- The specification in the top window.
- In the bottom "*Enabled operations*" window, you should see - **INITIALISATION({})** .

4. To begin the animation "*double-click*" on **INITIALISATION({})** .

5. You can now animate the *PaperRound* machine by "*double-clicking*" any of the operations that are listed there.

6. Note that **only operations that are enabled for the current state** are listed in this window.

7. Try all of the actions out & see what happens.

Exercise 1.6

Add an enquiry operation

```
ans <-- getsPapers( houseNumber )
```

that checks if the *housenumber* has papers delivered to it.

If it does then it outputs the number 1.

Hint: this operation can be defined by combining:

- the PRE-THEN-END of the *addNewHouse(newHouse)* operation &
- using a results variable like *numbHouses* in the *howManyHouses* operation.

Exercise 1.7

Add an operation

```
cancelPapers( houseNumber )
```

this cancels paper deliveries by deleting house's number from the set of house numbers that are delivered to.

Hints:

- (a) Think about what must be true about the house number for it to be deleted. (**Pre-condition**)
- (b) What effect should this operation have, i.e. what effect does it have. (**Post-condition**)
- (c) This is similar to the *addNewHouse(newHouse)* operation.

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