Modelling and testing

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Testing https://cartographia.hu/ webpage

1. Problem specification

On the Cartographia website, users can purchase a variety of maps, including maps of continents, countries, and cities, as well as road maps and tourist maps. Additionally, globes, books, and wall maps are available for purchase. In this assignment, I will test selected functionalities of this website, such as logging in, logging out, updating account details, changing password, creating and deleting addresses, selecting product categories both when logged in and without logging in, opening products in a dialog or view screen, and adding items to the cart either logged in or as a guest.
The essence of the task is to create a model that represents the selected features and then apply test-generating algorithms to the completed model.

2. Preconditions

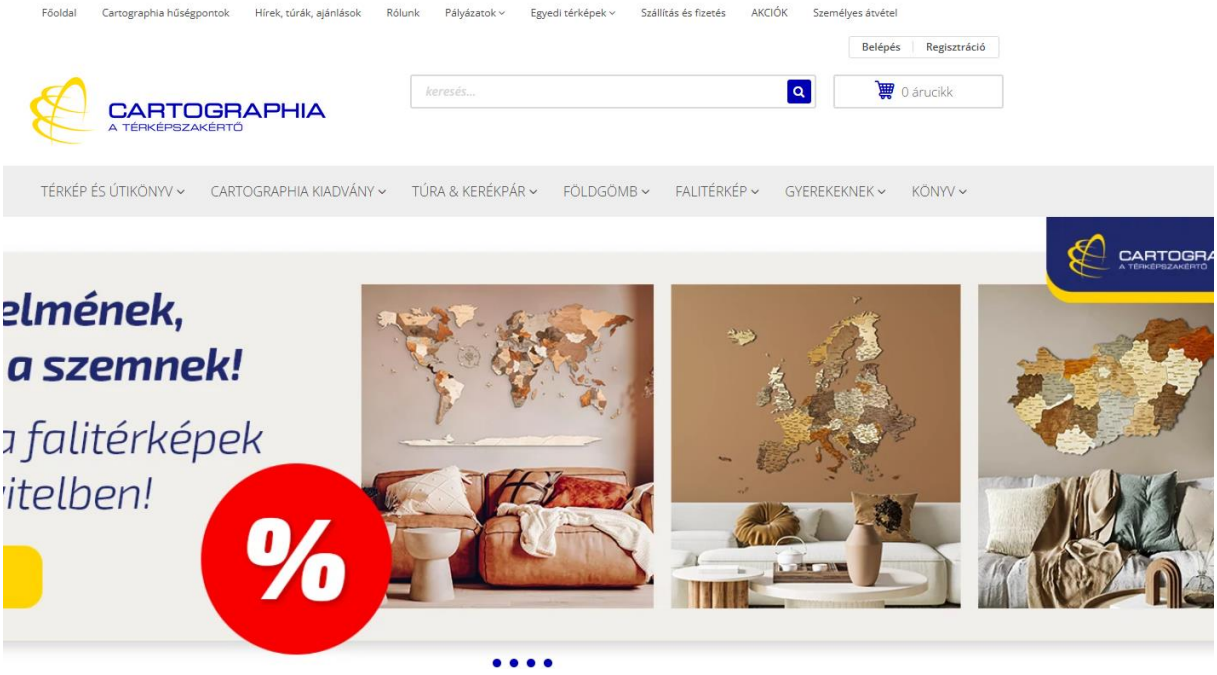
In order to test the account data, we will need a user account.

3. Analysing the problem and create EFSM model

3.1 About the system under test

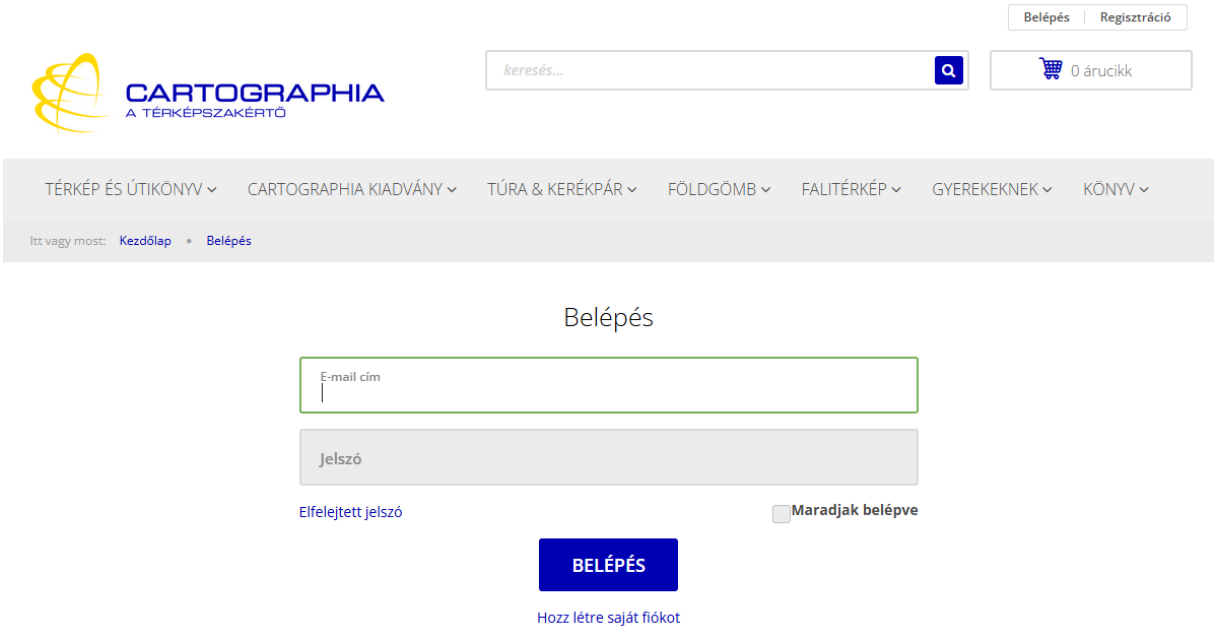
3.1.1 HomePage

When you open the website, you're directed to the **Not Signed In Main Page**.



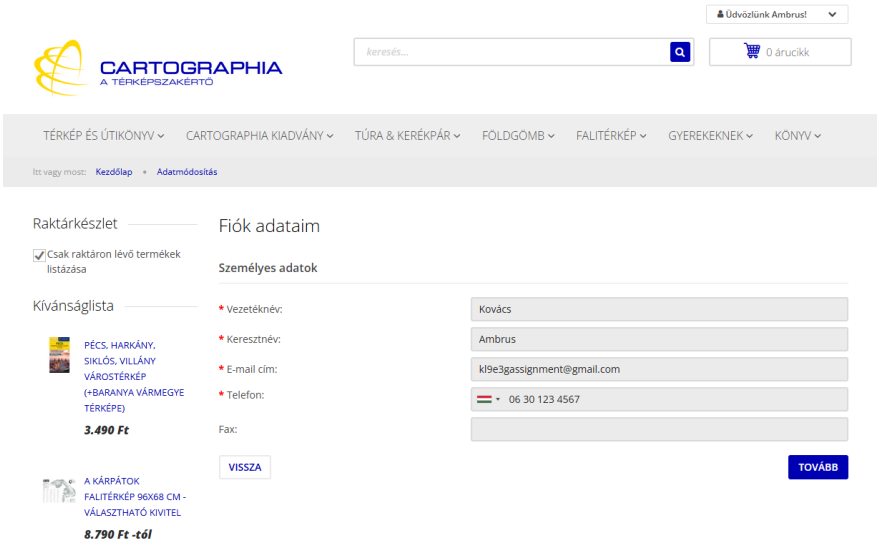
3.1.2 Login

To navigate to the **Sign In Page** from the **Not Signed In Main Page**, click on the **Login** button. This will redirect you to the **Sign In Page**, where you'll need to enter your email address and password, then click the **Login** button to sign in.
If incorrect credentials are entered (such as a wrong email or password), the system will display an error message. When the correct credentials are provided, the system will grant access to the user account and automatically open the **Account Page**.



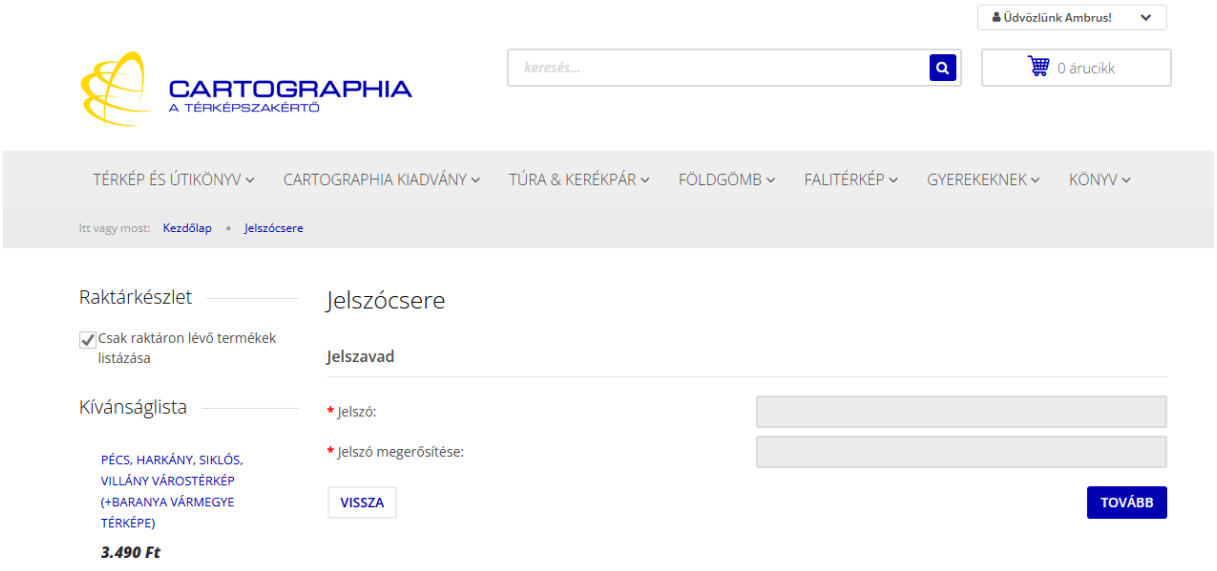
3.1.3 Change Account Data

If you're on the **Account Page**, you can access the **Change Account Data Page** to update your account details. The **Back** button on this page allows you to return to the **Account Page** without making any changes.
When updating information on the **Change Account Data Page**, ensure that all fields meet the required criteria (for example, the **name** field cannot be left empty). After entering valid information, clicking the **OK** button will save the changes and take you back to the **Account Page** with the updated data. If any field contains invalid information, an error message will appear, and you'll remain on the **Change Account Data Page** until all fields are corrected.



3.1.4 Change password

If we are on the **Account Page**, we can open the **Change Password Page** from there. We can navigate back to the **Account Page** using the **Back** button. If all data is entered correctly and we press the **OK** button, the password is changed, and we return to the **Account Page**. If the data is incorrect, an error message appears, and we remain on the current page.

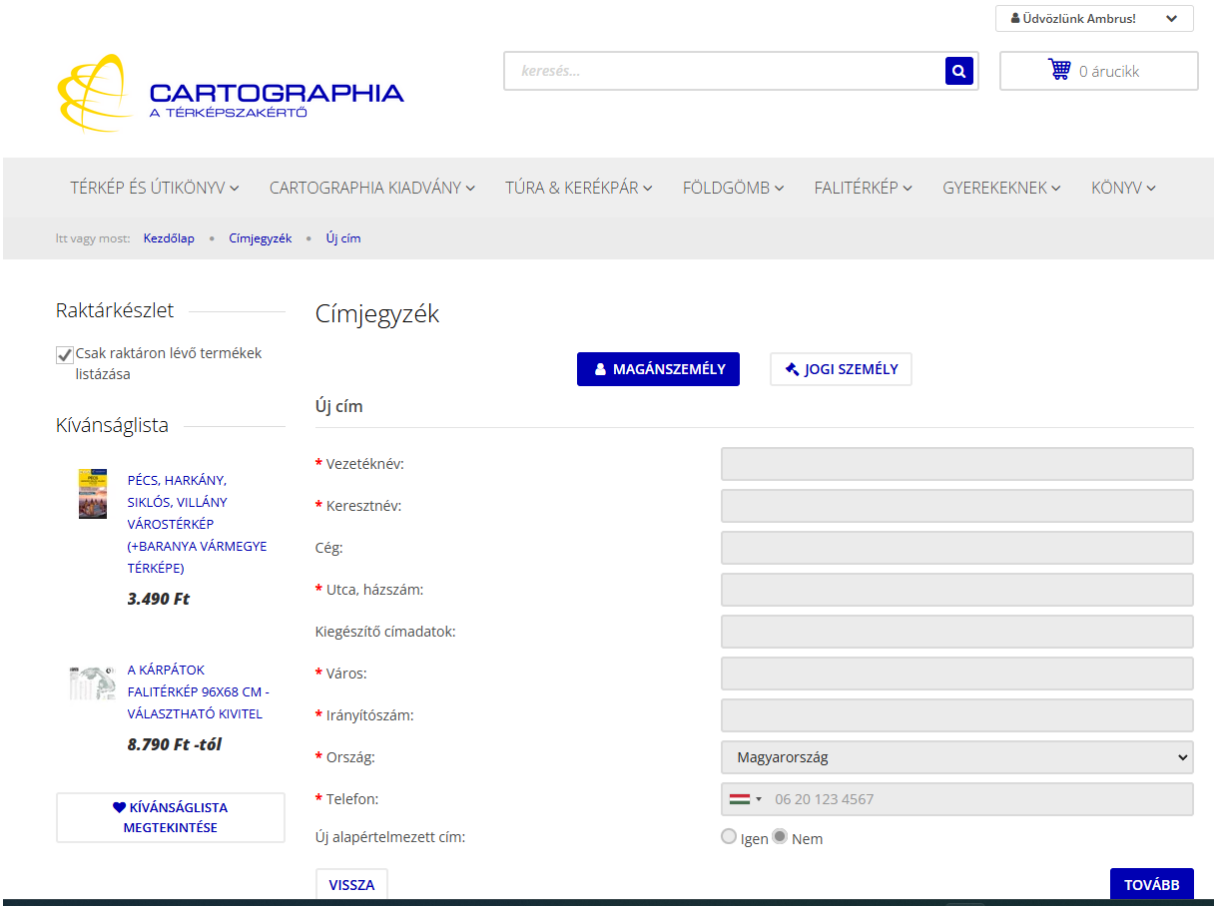


3.1.5 Address Book

If we are on the **Account Page**, we can open the **Address Book Page** from there. Here, we have the option to delete and create addresses.

3.1.5.1 Create Address

If we are on the **Address Book Page**, pressing the **New Address** button will open the **Create New Address Page**. We can return to the **Address Book Page** by clicking the **Back** button. If all information is entered correctly and we click **OK**, the new address will be created, and we will be redirected back to the **Address Book Page**. If the information is incorrect, the system will show an error, and we will remain on the **Create New Address Page**.



3.1.5.2 Delete Address

If we are on the **Address Book Page**, we can delete an address. If the deletion is unsuccessful, the system will display an error, and we will remain on the **Address Book Page**. If the deletion is successful, the system will confirm that the deletion was successful, and we will stay on the **Address Book Page**.

3.1.6 Select Product Category and list results

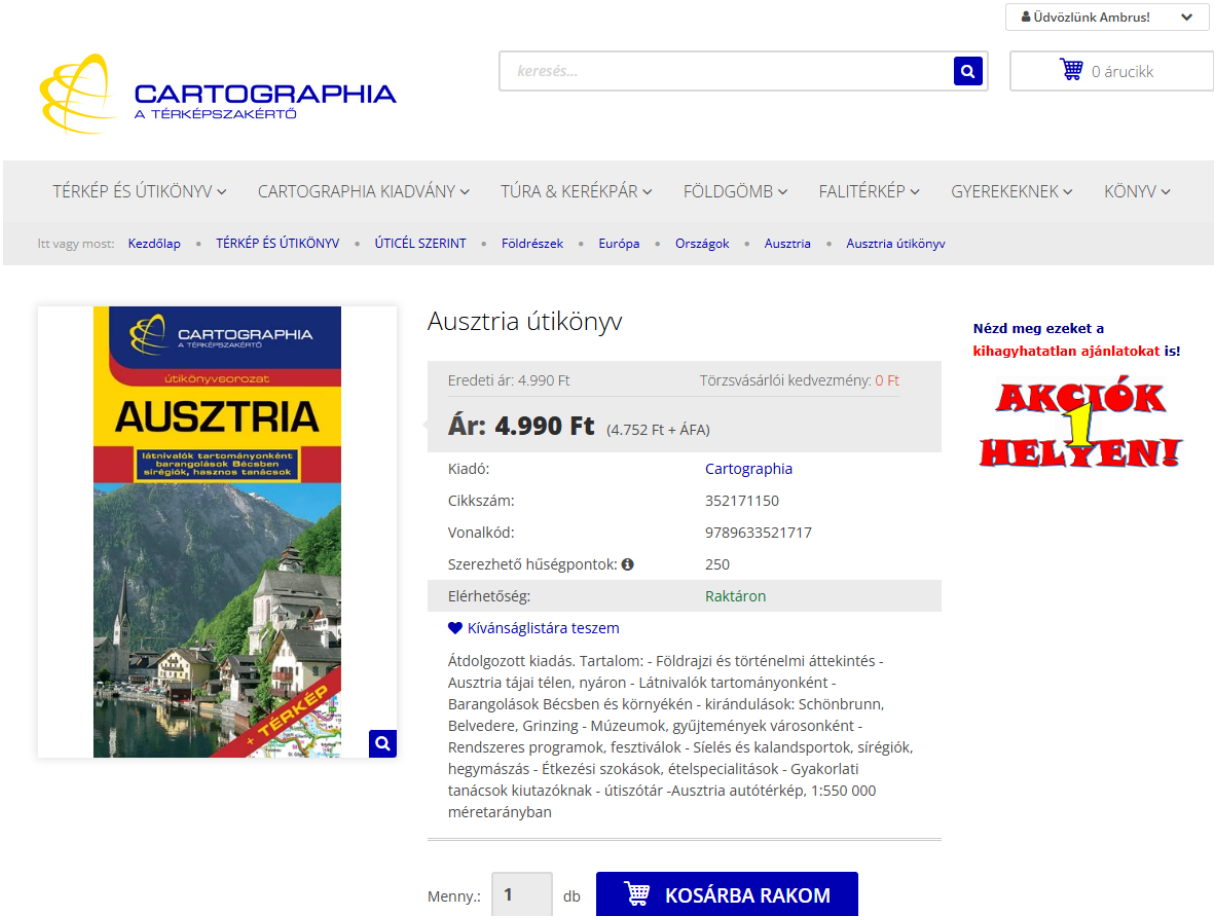
If we are logged in, selecting a product category from the menu will take us to the **Signed In Result Page**.

3.1.6.1 Open Item in Dialog (Signed In Item Dialog Page)

If we are on the **Signed In Result Page**, we can open a selected product in a dialog. In this dialog, we can add the product to the cart. Closing the dialog will return us to the **Signed In Result Page**.

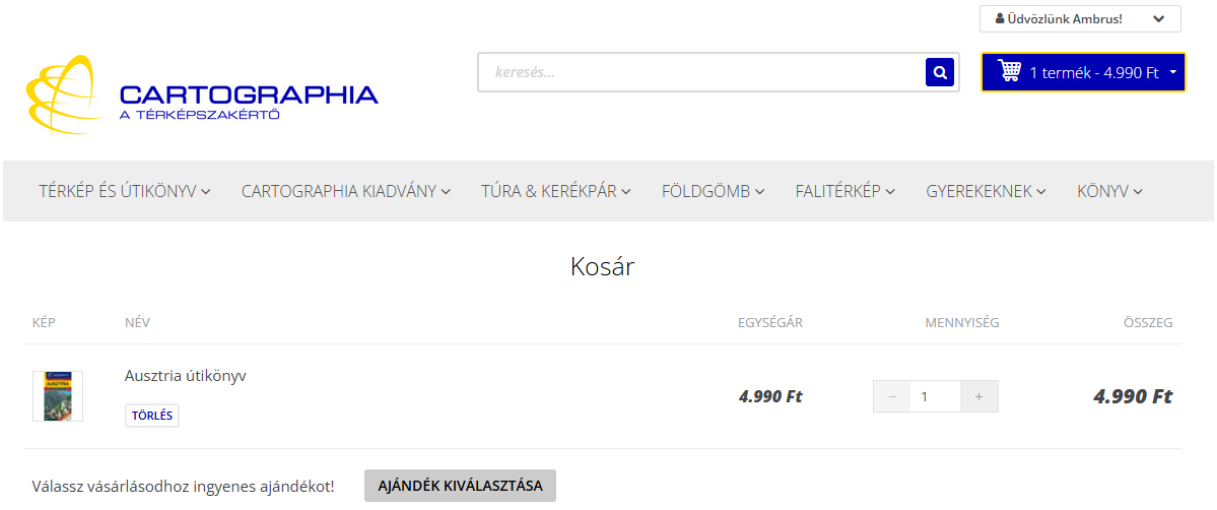
3.1.6.2 Open Item in View Page (Signed In Item View Page)

If we are on the **Signed In Result Page**, we can open a selected product to view the **Signed In Item View Page**. On the **Signed In Item View Page**, we have the option to add the product to the cart. From here, we can navigate back to the **Signed In Main Page**.



3.1.7 Open Cart (Signed In Cart Page)

If we are logged in, we can access the **Signed In Cart Page**. From this page, we have the option to navigate back to the **Signed In Main Page**.



3.1.8 Sign Out

If we are logged in, the **Logout button** will be displayed. By pressing the button, we can log out and will be redirected back to the **Not Signed In Main Page**.

3.1.9 Select Product Category and list results (In case of we are not signed in)

If we are not logged in, selecting a product category from the menu will take us to the **Not Signed In Result Page**.

3.1.9.1 Open Item in Dialog (Not Signed In Item Dialog Page, in case of we are not signed in)

If we are on the **Not Signed In Result Page**, we can open a selected product in a dialog. In this dialog, we can add the product to the cart. Closing the dialog will return us to the **Not Signed In Result Page**.

3.1.9.2 Open Item in View Page (Not Signed In Item View Page, in case of we are not signed in)

Ha a Not Signed In Result Page-en vagyunk, akkor egy kiválasztott terméknek meg tudunk nyitni a Not Signed In Item View Page-et. A Not Signed In Item View Page-en a terméket be tudjuk tenni a kosárba. Innen vissza tudunk vanigálni a Signed In Result Page-re.

If we are on the **Not Signed In Result Page**, we can open a selected product in the **Not Signed In Item View Page**. On the **Not Signed In Item View Page**, we can add the product to the cart. From there, we can navigate back to the **Not Signed In Main Page**.

3.1.10 Open Cart (Not Signed In Cart Page, in case of we are not signed in)

If we are not signed in, we can open the **Cart Page**. From there, we can navigate back to the **Not Signed In Main Page**.

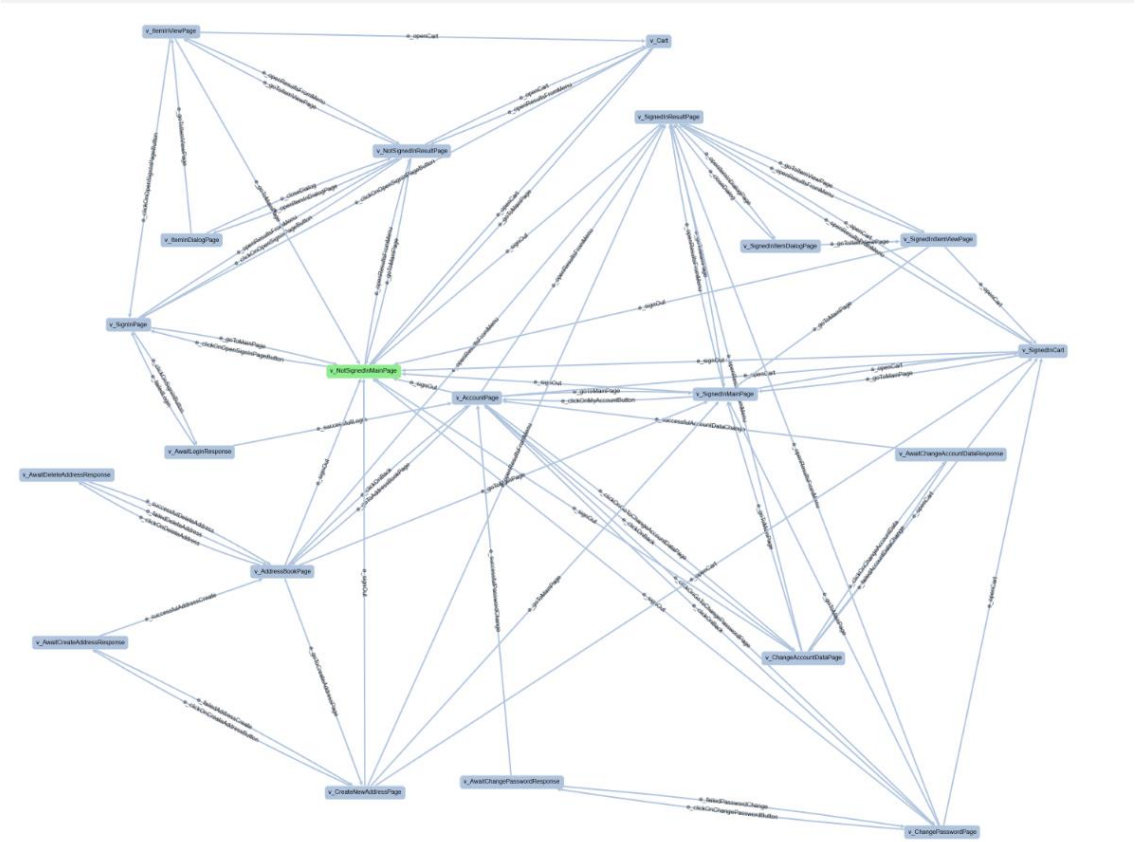
3.1.11 Not Signed In Main Page

If we are not signed in, we can reach the **Not Signed In Main Page** from any state.

3.1.12 Signed In Main Page

If we are signed in, we can reach the **Signed In Main Page** from any state.

3.2 The created EFSM model



v_NotSignedInMainPage	Main page (in case of not signed in)
v_NotSignedInResultPage	List products from a selected product category (in case of not signed in)
v_Cart	Cart (in case of not signed in)
v_ItemViewPage	View page of selected item (in case of not signed in)
v_ItemInDialogPage	Dialog page of item (in case of not signed in)
v_SignInPage	Sign In Form
v_AwaitLoginResponse	Wait state for login response
v_AccountPage	Here you can see your account details
v_SignedInMainPage	Main Page (in case of logged in)
v_SignedInResultPage	List products from a selected product category (in case of logged in)
v_SignedInCart	Cart (in case of logged in)
v_SignedInItemViewPage	View page of selected item (in case of logged in)
v_SignedInItemDialogPage	Dialog page of item (in case of logged in)
v_ChangeAccountDataPage	Here you can change account data
v_AwaitChangeAccountDataResponse	Wait state for save account data
v_ChangePasswordPage	Here you can change password

v_AwaitChangePasswordResponse	Wait state for save new password
v_AddressBookPage	Here you can see your Addresses
v_CreateNewAddressPage	Form Page for create new address
v_AwaitCreateAddressResponse	Wait state for address creation response
v_AwaitDeleteAddressResponse	Wait state for address deletion response

For a higher resolution version of the model, you can access it here. This model can be opened in GraphWalker.

4. Technical details

For model creation, I used *Graphwalker*. For test generation, I used the Modell 》 Test 》 Relax framework.

5. Test generation algoriths on model

5.1 Random transition walk with 50, 80 and 100 percent (run two times)

```
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4> ./MTR -m Random --random_coverage_type transition
 --random_coverage_percent 100 -f HomeWork-iosymbols.json
[U-CTRL ] [info] Version: 3.5.4 R4: Belted kingfisher, profile: DEFAULT, verbosity: 3, debug mode: off
[U-LMI  ] [info] Model Name: HomeWork, Type: FSM, Reset: No
[U-CTRL ] [info] Running Random test generation, coverage percent: 100.000000, coverage type: transition
[TG-RW  ] [info] Desired transition coverage reached: 100.0%,  Walk length: 12671
[TG-RW  ] [info] Finished computation at 2024-11-03 23:15:49.5500402
        elapsed time: (real time) 0.019546 s
        elapsed time: (user time) 0.020000 s
[TG-TGR ] [info] Test generation summary written: test_summary/random_result.csv
[U-TW   ] [info] Test suite written: test_suites/HomeWork-Random-transition-100-test_suite.json
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4>
```

```
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4> ./MTR -m Random --random_coverage_type transition
 --random_coverage_percent 50 -f HomeWork-iosymbols.json
[U-CTRL ] [info] Version: 3.5.4 R4: Belted kingfisher, profile: DEFAULT, verbosity: 3, debug mode: off
[U-LMI  ] [info] Model Name: HomeWork, Type: FSM, Reset: No
[U-CTRL ] [info] Running Random test generation, coverage percent: 50.000000, coverage type: transition
[TG-RW  ] [info] Desired transition coverage reached: 50.0%,  Walk length: 98
[TG-RW  ] [info] Finished computation at 2024-11-03 23:17:15.4172323
        elapsed time: (real time) 0.0003061 s
        elapsed time: (user time) 0.000000 s
[TG-TGR ] [info] Test generation summary written: test_summary/random_result.csv
[U-TW   ] [info] Test suite written: test_suites/HomeWork-Random-transition-50-test_suite.json
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4>
```

```
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4> ./MTR -m Random --random_coverage_type transition
 --random_coverage_percent 80 -f HomeWork-iosymbols.json
[U-CTRL ] [info] Version: 3.5.4 R4: Belted kingfisher, profile: DEFAULT, verbosity: 3, debug mode: off
[U-LMI  ] [info] Model Name: HomeWork, Type: FSM, Reset: No
[U-CTRL ] [info] Running Random test generation, coverage percent: 80.000000, coverage type: transition
[TG-RW  ] [info] Desired transition coverage reached: 80.0%,  Walk length: 746
[TG-RW  ] [info] Finished computation at 2024-11-03 23:17:38.6212553
        elapsed time: (real time) 0.0012838 s
        elapsed time: (user time) 0.002000 s
[TG-TGR ] [info] Test generation summary written: test_summary/random_result.csv
[U-TW   ] [info] Test suite written: test_suites/HomeWork-Random-transition-80-test_suite.json
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4>
```

Most relevant data from csv file:

modell_name	state_count	transition_count	method	duration_real	test_sequence_length	achived_percent
HomeWork	21	80	Random	0,0003061	98	50
HomeWork	21	80	Random	0,0002912	93	50
HomeWork	21	80	Random	0,0012838	746	80
HomeWork	21	80	Random	0,0022729	1428	80
HomeWork	21	80	Random	0,019546	12671	100
HomeWork	21	80	Random	0,0357642	23295	100

5.2 Transition tour (with and without Graphwiz):

```
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4> ./MTR -m TT -f HomeWork-iosymbols.json
[U-CTRL ] [info] Version: 3.5.4 R4: Belted kingfisher, profile: DEFAULT, verbosity: 3, debug mode: off
[U-LMI  ] [info] Model Name: HomeWork, Type: FSM, Reset: No
[U-CTRL ] [info] Running Transition Tour test generation
[TG-TT  ] [info] Not Eulerian, starting augmentation
[TG-TT  ] [info] Building bipartite graph
[TG-TT  ] [info] Bipartite graph successfully built
[TG-TT  ] [info] Creating minimum weight perfect matching
[TG-TT  ] [info] Matching done
[TG-TT  ] [info] Duplicating transitions according to matching
[TG-TT  ] [info] Augmentation over, checking if graph is Eulerian
[TG-TT  ] [info] Augmenting to Eulerian graph successful
[TG-TT  ] [info] Building spanning tree
[TG-TT  ] [info] Ordering edges
[TG-TT  ] [info] Edges ordered
[TG-TT  ] [info] Generating test sequence
[TG-TT  ] [info] Tour length: 152
[TG-TT  ] [info] Finished computation at 2024-11-03 23:46:57.1543966
        elapsed time: (real time) 0.0056035 s
        elapsed time: (user time) 0.006000 s
[TG-TGR ] [info] Test generation summary written: test_summary/tt_result.csv
[U-TW   ] [info] Test suite written: test_suites/HomeWork-TT-test_suite.json
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4>
```

```
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4> ./MTR -m TT -f HomeWork-iosymbols.json --graphviz
[U-CTRL ] [info] Version: 3.5.4 R4: Belted kingfisher, profile: DEFAULT, verbosity: 3, debug mode: off
[U-LMI  ] [info] Model Name: HomeWork, Type: FSM, Reset: No
[U-CTRL ] [info] Created graphviz dot file of original model: ./graphviz-TT
[U-CTRL ] [info] Running Transition Tour test generation
[TG-TT  ] [info] Not Eulerian, starting augmentation
[TG-TT  ] [info] Building bipartite graph
[TG-TT  ] [info] Bipartite graph successfully built
[TG-TT  ] [info] Creating minimum weight perfect matching
[TG-TT  ] [info] Matching done
[TG-TT  ] [info] Duplicating transitions according to matching
[TG-TT  ] [info] Augmentation over, checking if graph is Eulerian
[TG-TT  ] [info] Augmenting to Eulerian graph successful
[TG-TT  ] [info] Building spanning tree
[TG-TT  ] [info] Ordering edges
[TG-TT  ] [info] Edges ordered
[TG-TT  ] [info] Generating test sequence
[TG-TT  ] [info] Tour length: 152
[TG-TT  ] [info] Augmented model graphviz file created: graphviz/graphviz-TT/HomeWork_augmented.dot
[TG-TT  ] [info] Finished computation at 2024-11-03 23:47:54.7751234

        elapsed time: (real time) 0.0052248 s
        elapsed time: (user time) 0.006000 s
[TG-TGR ] [info] Test generation summary written: test_summary/tt_result.csv
[U-TW   ] [info] Test suite written: test_suites/HomeWork-TT-test_suite.json
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4>
```

Most relevant data from csv file:

modell_name	state_count	transition_count	method	duration_real	test_sequence_length	graphviz_enabled
HomeWork	21	80	TT	0,0056035	152	false
HomeWork	21	80	TT	0,0052248	152	true

3.3 All-transition-state

```
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4> ./MTR -m ATS -f HomeWork-iosymbols.json
[U-CTRL ] [info] Version: 3.5.4 R4: Belted kingfisher, profile: DEFAULT, verbosity: 3, debug mode: off
[U-LMI  ] [info] Model Name: HomeWork, Type: FSM, Reset: No
[U-CTRL ] [info] Running All-Transition-State test generation, depth: 0
[TG-ATS0] [info] Running AT traversal on original model
[TG-AT  ] [info] Not Eulerian, starting augmentation
[TG-AT  ] [info] Building bipartite graph
[TG-AT  ] [info] Bipartite graph successfully built
[TG-AT  ] [info] Creating minimum weight perfect matching
[TG-AT  ] [info] Matching done
[TG-AT  ] [info] Duplicating transitions according to matching
[TG-AT  ] [info] Augmentation over, checking if graph is Eulerian
[TG-AT  ] [info] Augmenting to Eulerian graph successful
[TG-AT  ] [info] Building spanning tree
[TG-AT  ] [info] Ordering edges
[TG-AT  ] [info] Edges ordered
[TG-AT  ] [info] AT traversal stopped on state: v_NotSignedInMainPage
[TG-ATS0] [info] OG traversal done
[TG-ATS0] [info] Running AT traversal on extended spanning tree graph
[TG-ATS0] [info] Spanning tree with paths to the leaf nodes built, num of arcs: 37, total: 80
[TG-AT  ] [info] Not Eulerian, starting augmentation
[TG-AT  ] [info] Building bipartite graph
[TG-AT  ] [info] Bipartite graph successfully built
[TG-AT  ] [info] Creating minimum weight perfect matching
[TG-AT  ] [info] Matching done
[TG-AT  ] [info] Duplicating transitions according to matching
[TG-AT  ] [info] Augmentation over, checking if graph is Eulerian
[TG-AT  ] [info] Augmenting to Eulerian graph successful
[TG-AT  ] [info] Building spanning tree
[TG-AT  ] [info] Ordering edges
[TG-AT  ] [info] Edges ordered
[TG-AT  ] [info] AT traversal stopped on state: v_AwaitChangeAccountDataResponse
[TG-ATS0] [info] Running AT traversal on complementary spanning tree graph
[TG-ATS0] [warning] Complement CT graph not strongly connected, alternate sequences won't be completely arc disjoint.
[TG-ATS0] [info] SC graph transition count: 15
[TG-ATS0] [info] Successfully restored strongly connected property transitions used: 23
[TG-AT  ] [info] Not Eulerian, starting augmentation
[TG-AT  ] [info] Building bipartite graph
[TG-AT  ] [info] Bipartite graph successfully built
[TG-AT  ] [info] Creating minimum weight perfect matching
[TG-AT  ] [info] Matching done
[TG-AT  ] [info] Duplicating transitions according to matching
[TG-AT  ] [info] Augmentation over, checking if graph is Eulerian
[TG-AT  ] [info] Augmenting to Eulerian graph successful
[TG-AT  ] [info] Building spanning tree
[TG-AT  ] [info] Ordering edges
[TG-AT  ] [info] Edges ordered
[TG-AT  ] [info] AT traversal stopped on state: v_SignedInResultPage
[TG-ATS0] [info] Result:
        OG AT: 152, OG TSP: 33
        ST AT: 65, ST TSP: 41
        CST AT: 127, CST TSP: 34

[TG-ATS0] [info] Finished computation at 2024-11-03 23:49:46.6237452
        elapsed time: (real time) 0.0191841 s
        elapsed time: (user time) 0.019000 s
[TG-TGR ] [info] Test generation summary written: test_summary/ats_result.csv
[U-TW   ] [info] Test suite written: test_suites/HomeWork-ATS0-test_suite.json
PS C:\Users\matek\OneDrive_2024-11-03\ModelTestRelax 3-5-4 windows executable\MTR-3-5-4\MTR-3-5-4>
```

Most relevant data from csv file:

modell_name	state_count	transition_count	method	duration_real	test_sequence_length
HomeWork	21	80	ATS	0,0191841	452

You can check the Graphviz and csv results here.

Sources:

1. Graphwalker
2. Cartographia
3. Modell 》 Test 》 Relax Framework
4. Class materials