Read-Me for GARP experiment

I. About the experiment

The experiment is designed to measure the amount of inconsistency within individuals across their choices using the Generalized Axiom of Revealed Preferences (GARP). Binary choices containing some of 5 goods are presented in 4 blocks of 38 for a total of 150 trials. Each trial of treatments S (35 trials) and C (105 trials) consists of a choice between bundles of two goods, or a choice between two points on a budget line. For treatment S trials, subjects make choices between bundles containing two goods, where both bundles consist of the same two goods. For treatment C trials, subjects make choices between two-good bundles, where only one of the two goods in each bundle is common to both bundles. There are three sub-types of treatment C trials: in C1 good 3 is common to both bundles, in C2 good 4 is common to both bundles, and in C3 good 5 is common to both bundles. Each trial of treatment A (10 trials) consists of a choice between some quantity of a good and another quantity of the same good. Trials of different treatments are presented in random order. A working memory test succeeds the choice experiment.
The analyses scripts count the number of GARP violations for a subject, as well as measure the severity of violations - by using a discretized version of Afriat's index (CKB index here) and by counting the number of choices that need to be omitted to achieve consistency. The analyses scripts also use Maximum Likelihood Estimation (MLE) to determine the probability that each subject is utilizing one of several possible heuristics, or strategies, in their choices, and to report the best-fit heuristic.
The goods (see: Changing the images) and budget lines (see: Changing the sets) can be changed, with some restrictions.

II. Preparing to collect data

Setting the path:
- From the folder **GARP_public** folder, open the function **runGARPSubject.m**
- Correct the path in lines 10-14 of function to specify the location where you have saved the MATLAB files (if you have downloaded it, then it will be in **Downloads**. It might be a better idea to save the files elsewhere, such as on your **Desktop**).

Changing the images:
- As it is, the images in the folder **Images** are of five different foods.
- Place images of goods that you would like to use in the experiment in this folder. There must be at least five different images for the experiment to run as intended. Do not delete or move the image files titled "grey.jpg" and "black.jpg." Image files must be named as such: "Image" followed by a number (e.g. Image1, Image2, Image3, ...).

Changing the sets:
- As it is, trials are created by budget lines defined in the folder **Sets** (35 budget lines for treatment S and treatment C trials in **setTreatSC.mat** and 10 for treatment A trials in **setTreatA.mat**).
- Specify sets that you would like to use in the experiment and save it under the same name (**setTreatSC.mat** and **setTreatA.mat**). The size of the file must be the same for the experiment to run as intended.

Testing the script:
If you would like to run the experiment as a test, press the green arrow in Editor window of the function **runGARPSubject.m**

III. Collecting data

Running the experiment:
- In MATLAB's command window, type

> > runGARPSubject(subjID, item1c, item2c, item3c, item4c, item5c, input)

where "subjID" is the subject ID number, "item1c"-"item5c" are numbers identifying the goods to be used for the subject's experiment, and "input" is either "k" for keyboard, "m" for mouse, or "t" for tablet

Subject-specific data will be saved in **GARP_public** > **Data** > **records** > file name beginning with their subject ID number:

1. **settings.mat** - subject-specific settings data saved here
2. **behavioral.mat** - behavioral data saved here
3. **reward.mat** - chosen bundle from randomly-selected reward trial. The values in the first row identify the two goods to be paid-out and the values in the second row identify the number of each good to be paid-out

Note: raw data should not be used for any type of analysis. The order of trials, as well as the left-right order within trials, presented to subjects within each treatment is random and so, data needs to be pre-processed first.

IV. Running analyses and reading results

Running analyses:
- From the folder **GARP_public** folder, open the script **runAnalyses.m**
- Correct the path in lines 2-6 of script to specify the location where you have saved the MATLAB files (again, if you have downloaded it, then it will be in **Downloads**. It might be a better idea to save the files elsewhere, such as on your **Desktop**).
- Press the green arrow in Editor window to run the script

Reading the results:
Subject-specific data will be saved in **GARP_public** > **Data** > **preProcessed** > file name is subject ID number:

1. **preProcessed.mat** -
   settings (**order**, **tasks**) and behavioral data (**choices**, **rxntimes**) by treatment
2. **strategy.mat** -
   strategy-related analyses by treatment
3. **violation.mat** -
   violation count and severity by treatment

Summary data for all subjects will be saved in **GARP_public** > **Data** > **preProcessed**:

1. **MLEstrategySummary.mat** -
   a. **treatS**
      column 1. best-fit strategy (heuristic) based on MLE with only treatment S choices
      column 2. probability the strategy was utilized
   b. **treatC**
      column 1. best-fit strategy based on MLE with only treatment C choices
      column 2. probability the strategy was utilized

c. **treatAll**

column 1. best-fit strategy based on MLE with both treatment S and C choices
column 2. probability the strategy was utilized

2. **severitySummary.mat** -

a. **severeIndxOmitSummary**

column 1. subject ID number
column 2. number of choices to omit for consistency in treatment S
column 3. number of choices to omit for consistency in treatment C1 (direct)
column 4. number of choices to omit for consistency in treatment C2 (direct)
column 5. number of choices to omit for consistency in treatment C3 (direct)
column 6. number of choices to omit for consistency in treatment CI (indirect)

b. **severeIndxCKBavgSummary**

column 1.subject ID number
column 2. CKB severity (average) index for treatment S violating choices
column 3. CKB severity (average) index for treatment C1 (direct) violating choices
column 4. CKB severity (average) index for treatment C2 (direct) violating choices
column 5. CKB severity (average) index for treatment C3 (direct) violating choices
column 6. CKB severity (average) index for treatment CI (indirect) violating choices
column 7. CKB severity (average) index for treatment S and C violating choices
column 8. CKB severity (average) index for treatment C (direct + indirect) violating choices

c. **severeIndxCKBminSummary**

column 1. subject ID number
column 2. CKB severity (min) index for treatment S violating choices
column 3. CKB severity (min) index for treatment C1 (direct) violating choices
column 4. CKB severity (min) index for treatment C2 (direct) violating choices
column 5. CKB severity (min) index for treatment C3 (direct) violating choices
column 6. CKB severity (min) index for treatment CI (indirect) violating choices
column 7. CKB severity (min) index for treatment S and C violating choices
column 8. CKB severity (min) index for treatment C (direct + indirect) violating choices

3. **strategySummary.mat**

column 1. subject ID number
columns 2-8. number of choices matching each of 7 possible heuristics for treatment S
the following columns are used in MLE:
column 2. heuristic of maximizing absolutely (regardless of item)
column 3. heuristic of maximizing amount of item 1
column 4. heuristic of maximizing amount of item 2
column 5. heuristic of minimizing absolutely (regardless of item)
column 8. maximizing utility

columns 9-19. number of choices matching each of 11 possible heuristics for treatment C
the following columns are used in MLE:
column 9. heuristic of maximizing absolutely
column 10. heuristic of minimizing absolutely
column 11. heuristic of maximizing amount of item 3
column 12. heuristic of maximizing amount of item 4
column 14. heuristic of maximizing amount of item 5
column 19. maximizing utility

column 20-32. number of choices matching each of 13 possible heuristics for treatments S and C
the following columns are used in MLE: column 9. heuristic of maximizing absolutely
column 20. heuristic of minimizing absolutely
column 21. heuristic of maximizing amount of item 1
column 22. heuristic of maximizing amount of item 2
column 23. heuristic of minimizing absolutely

column 25. heuristic of maximizing amount of item 3
column 26. heuristic of maximizing amount of item 4
column 27. heuristic of maximizing amount of item 5
column 32. maximizing utility

4. **violationSummary.mat**
   column 1. subject ID number
   column 2. treatment A violations
   column 3. treatment S violations
   column 4. treatment C1 (direct) violations
   column 5. treatment C2 (direct) violations
   column 6. treatment C3 (direct) violations
   column 7. treatment CI (indirect) violations
   column 8. treatment C (direct + indirect) violations

To read results from the WM test, please refer to:

Lewandowsky, Stephan, Klaus Oberauer, Lee-Xieng Yang, and Ullrich K. H. Ecker. "A Working Memory Test Battery for MATLAB." *Behavior Research Methods* 42.2 (2010): 571-85. Web.