Documentation For Replication Packages

1 Prerequisites

You should have the following properly installed on your device:

- `Python`
- `Jupyter Notebook`
- Python packages
  - `matplotlib`
  - `numpy`
  - `pandas`
  - `scipy`
  - `scikit-learn`
  - `seaborn`
  - `statsmodels`

2 Numerical Results

2.1 Figure 1, Figure B.1-B.5

1. Open `Utility Difference.ipynb`.
2. Import packages and run section *Main Program*.
3. Run section *Computation* to generate numerical prediction data files (can take hours) `[n]_[aa]_[xxx].csv` where

- `n` is the number of bidders
- `aa` is the auction format where the Dutch auction is denoted by `da` and the Honolulu auction is denoted by `ha`
- `xxx` is the predicted auction characteristic where `ED, ER, EUa, EUb` stands for the expected duration, selling price, utility for bidders, utility for the auctioneer respectively.

4. Run section *Relative difference* and adjust functional arguments to get

- Figure 1
  - `graphPctHeatmap(eval_n=50, eval_interval=0.02, type="ED")`
  - `graphPctHeatmap(eval_n=50, eval_interval=0.02, type="ER")`
  - `graphPctHeatmap(eval_n=50, eval_interval=0.02, type="EUa")`
  - `graphPctHeatmap(eval_n=50, eval_interval=0.02, type="EUb")`
- Figure B.2
  - `graphPctHeatmap2(eval_n=50, eval_interval=0.02, type="ED")`
- Figure B.3
  - `graphPctHeatmap2(eval_n=50, eval_interval=0.02, type="ER")`
- Figure B.4
  - `graphPctHeatmap2(eval_n=50, eval_interval=0.02, type="EUa")`
- Figure B.5
  - `graphPctHeatmap2(eval_n=50, eval_interval=0.02, type="EUb")`

5. Run section *Jumps in the optimal starting price* s to get

- Figure B.1

2.2 Table B.1

1. Open `Fish_Auction.ipynb`.
2. Run section *Main program*.
3. Run section *Outputs for research use -> Table of concerned variables for parameters used in the experiment* to get

- Table B.1

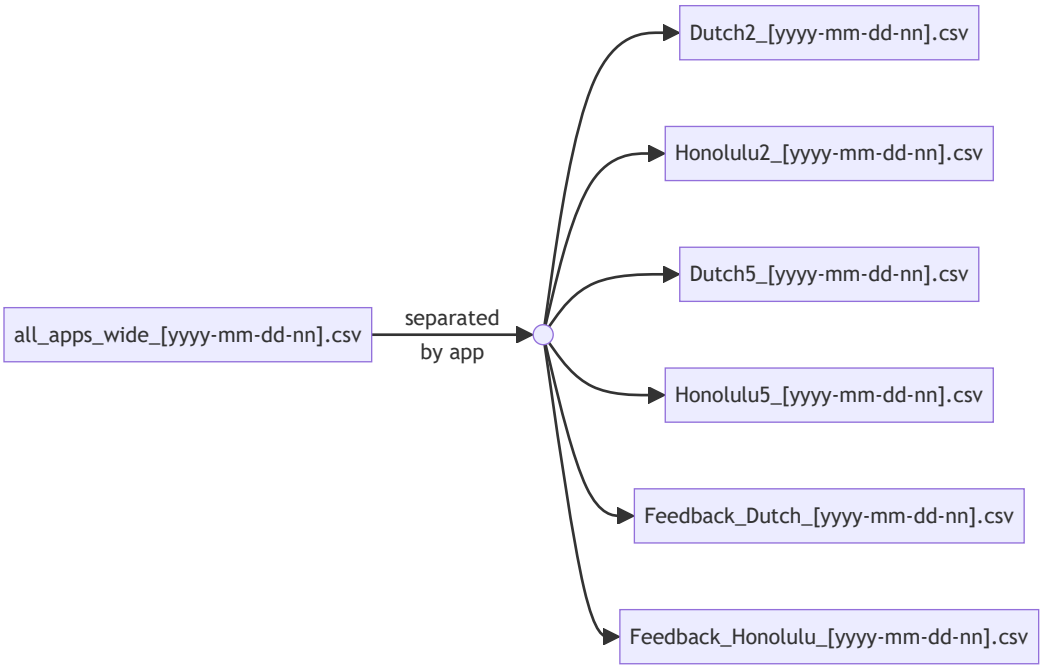
- `table(a=1, b=0.45, c=0.95, list_n=[2, 5])` for columns 2L and 5L
- `table(a=1, b=0.95, c=0.95, list_n=[2, 5])` for columns 2H and 5H

3 Experimental Results

3.1 Have all data files ready

3.1.1 Raw data

The raw data of each experimental session is stored in `all_apps_wide_[yyyy-mm-dd-nn].csv`, where `yyyy-mm-dd` is the date of the session, `nn` is the session ID assigned by the experimenter. This all-in-one date file can be separated by app. Both formats of raw data are provided.



3.1.2 Process raw data

1. The following files should be put in the same folder:

- `all_apps_wide_[yyyy-mm-dd-nn].csv`
- `Data Reformat.ipynb`

2. Run `Data Reformat.ipynb` from the beginning to the second last section, change `str_date` accordingly for each session. You should get the following processed data files:

- `all_apps_wide_[yyyy-mm-dd-nn].csv`
  - `Dutch_new_[yyyy-mm-dd-nn].csv`
  - `Honolulu_new_[yyyy-mm-dd-nn].csv`
    - `Honolulu_rounded_and_accurate_[yyyy-mm-dd-nn].csv`
  - `Feedback_Dutch_new_[yyyy-mm-dd-nn].csv`
  - `Feedback_Honolulu_new_[yyyy-mm-dd-nn].csv`

3. Merge these session-wide files manually to get the following all-session processed data files:

- `Dutch_new_all_session.csv`
- `Honolulu_new_all_session.csv`
  - `Honolulu_rounded_and_accurate_all_session.csv`
- `Feedback_Dutch_new_all_session.csv`
- `Feedback_Honolulu_new_all_session.csv`

4. Run the last section of `Data Reformat.ipynb` to get the final version of processed data files:

- `Dutch_new_all_session.csv`
  - `Dutch_paydiff_norm.csv`
- `Honolulu_new_all_session.csv`
  - `Honolulu_rounded_and_accurate_all_session.csv`
    - `Honolulu_paydiff_norm.csv`
- `Feedback_Dutch_new_all_session.csv`
- `Feedback_Honolulu_new_all_session.csv`

3.2 Table 1

It's basic experimental design and session information. No codes are provided.

3.3 Table 2, Table 5, Table D.1-D.3

1. Put the following files in the same folder:

- `Dutch_paydiff_norm.csv`
- `Honolulu_paydiff_norm.csv`
- `Dominated behaviour.ipynb`

2. Open `Dominated behaviour.ipynb` .
3. Import packages and data files, then run section *Three price dynamics in Honolulu* to get

- Table 2
  - "Actual" columns
    - `priceDynamics(rmin=3, rmax=30, tol=2, is_actual=True)`
  - "Predicted" columns
    - `priceDynamics(rmin=3, rmax=30, tol=2, is_actual=False)`
- Table D.1
  - All treatments
    - `signedRankTest(rmin=3, rmax=30, tol=2, altH="greater", altD="less", altE="less")`
    - `signedRankTest(rmin=3, rmax=30, tol=2, altH="two-sided", altD="two-sided", altE="two-sided")`
  - 2-bidder
    - `signedRankTestByNumber(rmin=3, rmax=30, tol=2, n=2, altH="greater", altD="less", altE="less")`
    - `signedRankTestByNumber(rmin=3, rmax=30, tol=2, n=2, altH="two-sided", altD="two-sided", altE="two-sided")`
  - 5-bidder
    - `signedRankTestByNumber(rmin=3, rmax=30, tol=2, n=5, altH="greater", altD="less", altE="less")`
    - `signedRankTestByNumber(rmin=3, rmax=30, tol=2, n=5, altH="two-sided", altD="two-sided", altE="two-sided")`
  - 2H
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=2, b=0.019, altH="greater", altD="less", altE="less")`
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=2, b=0.019, altH="two-sided", altD="two-sided", altE="two-sided")`
  - 2L
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=2, b=0.009, altH="greater", altD="greater", altE="less")`
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=2, b=0.009, altH="two-sided", altD="two-sided", altE="two-sided")`
  - 5H
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=5, b=0.019, altH="greater", altD="less", altE="less")`
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=5, b=0.019, altH="two-sided", altD="two-sided", altE="two-sided")`
  - 5L
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=5, b=0.009, altH="greater", altD="less", altE="less")`
    - `signedRankTestByTreatment(rmin=3, rmax=30, tol=2, n=5, b=0.009, altH="two-sided", altD="two-sided", altE="two-sided")`

4. Run section *SD & WD decisions* to get

- Table 5, Table D.2
  - Dutch auction "Top" columns
    - `tableSD(n=2, b=0.019, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
    - `tableSD(n=2, b=0.009, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
    - `tableSD(n=5, b=0.019, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
    - `tableSD(n=5, b=0.009, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
  - Dutch auction "Bottom" columns

        - `tableSD(n=2, b=0.019, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
        - `tableSD(n=2, b=0.009, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
        - `tableSD(n=5, b=0.019, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
        - `tableSD(n=5, b=0.009, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
    - Honolulu auction “Top” columns
        - `tableWD(n=2, b=0.019, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
        - `tableWD(n=2, b=0.009, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
        - `tableWD(n=5, b=0.019, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
        - `tableWD(n=5, b=0.009, rmin=3, rmax=30, qmin=0.501, qmax=1, tol=2)`
    - Honolulu auction “Bottom” columns
        - `tableWD(n=2, b=0.019, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
        - `tableWD(n=2, b=0.009, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
        - `tableWD(n=5, b=0.019, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
        - `tableWD(n=5, b=0.009, rmin=3, rmax=30, qmin=0, qmax=0.5, tol=2)`
- Table D.3
    - All treatments
        - `signedRankUndominatedDutch(rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonolulu(rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altEL="greater", altDrop="greater")`
    - 2-bidder
        - `signedRankUndominatedDutchByNumber(n=2, rmin=3, rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonoluluByNumber(n=2, rmin=3, rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altEL="greater",`
    - 5-bidder
        - `signedRankUndominatedDutchByNumber(n=5, rmin=3, rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonoluluByNumber(n=5, rmin=3, rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altEL="greater",`
    - 2H
        - `signedRankUndominatedDutchByTreatment(n=2, b=0.019, rmin=3, rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonoluluByTreatment(n=2, b=0.019, rmin=3, rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altE`
    - 2L
        - `signedRankUndominatedDutchByTreatment(n=2, b=0.009, rmin=3, rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonoluluByTreatment(n=2, b=0.009, rmin=3, rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altE`
    - 5H
        - `signedRankUndominatedDutchByTreatment(n=5, b=0.019, rmin=3, rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonoluluByTreatment(n=5, b=0.019, rmin=3, rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altE`
    - 5L
        - `signedRankUndominatedDutchByTreatment(n=5, b=0.009, rmin=3, rmax=30, tol=2, alt="greater")`
        - `signedRankUndominatedHonoluluByTreatment(n=5, b=0.009, rmin=3, rmax=30, tol=2, altDB="greater", altCL="greater", altCB="greater", altE`

3.4 Table 3, Figure 3-4, Figure 7, Figure E.1

1. Put the following files in the same folder:

- `Dutch_paydiff_norm.csv`
- `Honolulu_paydiff_norm.csv`
- `Zero-cost prediction.ipynb`
- `Summary statistics.ipynb`

2. Open `Zero-cost prediction.ipynb` and run from the beginning to the end to generate two new data files in the same folder:

- `Dutch_paydiff_norm_zerocost.csv`
- `Honolulu_paydiff_norm_zerocost.csv`

3. Open `Summary statistics.ipynb` .
4. Import packages and data files, then run section *Auction characteristics* to get

- Figure 3
    - Subsection *Efficiency*
- Figure 4(a), Figure E.1
    - Subsection *Duration*
- Figure 4(b)

    - Subsection *Revenue*
- Figure 4(c)
    - Subsection *Bidder utility*
- Figure 4(d)
    - Subsection *Auctioneer utility*

5. Run subsection *Bid deviation -> Top and bottom earners* to get

- Figure 7
    - Left panel
        - `plotDbid()`
    - Right panel
        - `plotDstage()`

3.5 Figure 5, Figure F.1

1. Put the following files in the same folder:

- `Dutch_paydiff_norm.csv`
- `Honolulu_paydiff_norm.csv`
- `Test main effects.ipynb`

2. Open `Test main effects.ipynb` .
3. Import packages and data files, then run section *Clustering Based On Similarity* to get

- Figure F.1
    - Subsection *K-means*
        - `plotCluster(2, 0.019, 3)`
        - `plotCluster(2, 0.009, 3)`
        - `plotCluster(5, 0.019, 3)`
        - `plotCluster(5, 0.009, 4)`
- Figure 5
    - Subsection *Percentage paydiff distribution*

3.6 Figure 10-11

1. Put the following files in the same folder:

- `Feedback_Dutch_new_all_session.csv.csv`
- `Feedback_Honolulu_new_all_session.csv.csv`
- `Feedback plots.ipynb`

2. Open `Feedback plots.ipynb` and run from the beginning to the end to get

- Figure 10
    - Section *Winner regret*
- Figure 11
    - Section *Loser regret*

3.7 Table 4, Table C.1-C.2

1. Put the following files in the same folder:

- `Dutch_paydiff_norm.csv`
- `Honolulu_paydiff_norm.csv`
- `Bootstrap estimation_auction characteristics.ipynb`

2. Open `Bootstrap estimation_auction characteristics.ipynb` .
3. Import packages and data files, then run section *Functions* for preparation.
4. Run section *Baseline Regression and Prediction* to get

- Table C.1

    - “Auctioneer payoff” columns
        - Subsection *Auctioneer utility -> reg cost, 2 bidders*
        - Subsection *Auctioneer utility -> reg cost, 5 bidders*
    - “Buyer payoff” columns
        - Subsection *Bidder utility -> reg cost, 2 bidders*
        - Subsection *Bidder utility -> reg cost, 5 bidders*
    - “Efficiency” columns
        - Subsection *Efficiency -> reg cost, 2 bidders*
        - Subsection *Efficiency -> reg cost, 5 bidders*
        - Subsection *Efficiency -> pooled*
- Table C.2
    - “Buyer payoff” columns
        - Subsection *Bidder utility -> reg bidders, high cost*
        - Subsection *Bidder utility -> reg bidders, low cost*
    - “Auction duration” columns
        - Subsection *Auction duration -> reg bidders, high cost*
        - Subsection *Auction duration -> reg bidders, low cost*
    - “Selling price” columns
        - Subsection *Selling price -> reg bidders, high cost*
        - Subsection *Selling price -> reg bidders, low cost*

5. Run section *Blocked Bootstrap* to get

- Table 4 (double-check Stata results, bootstrap results are different because of different random seeds)
    - “Efficiency” rows
        - Subsection *Efficiency pooled -> H = D*
        - Subsection *Efficiency -> H = D (high cost) for 2 bidders, H = D (low cost) for 2 bidders*
        - Subsection *Efficiency -> H = D (high cost) for 5 bidders, H = D (low cost) for 5 bidders*
    - “Duration” rows
        - Subsection *Auction duration-> D > H (2 bidders) for high cost, D > H (5 bidders) for high cost*
        - Subsection *Auction duration-> D > H (2 bidders) for low cost, D > H (5 bidders) for low cost*
        - Subsection *Auction duration-> H/D (5 bidders) > H/D (2 bidders) for high cost*
        - Subsection *Auction duration-> H/D (5 bidders) > H/D (2 bidders) for low cost*
    - “Selling price” rows
        - Subsection *Selling price -> H/D (5 bidders) = 0.988 for high cost, H/D (2 bidders) = 0.917 for high cost*
        - Subsection *Selling price -> H/D (5 bidders) = 0.991 for low cost, H/D (2 bidders) = 1.011 for low cost*
    - “Auctioneer utility” rows
        - Subsection *Auctioneer utility -> H > D (2 bidders) for high cost, H > D (5 bidders) for high cost*
        - Subsection *Auctioneer utility -> H > D (2 bidders) for low cost, H > D (5 bidders) for low cost*
    - “Buyer utility” rows
        - Subsection *Bidder utility -> H > D (2 bidders) for high cost, H > D (5 bidders) for high cost*
        - Subsection *Bidder utility -> H > D (2 bidders) for low cost, H > D (5 bidders) for low cost*
        - Subsection *Bidder utility -> H/D (high cost) > H/D (low cost) for 2 bidders*
        - Subsection *Bidder utility -> H/D (5 bidders) < H/D (2 bidders) for high cost*
        - Subsection *Bidder utility -> H/D (5 bidders) < H/D (2 bidders) for low cost (mean and variance are not consistent)*

3.8 Figure 7 p-values

1. Put the following files in the same folder:

- `Dutch_paydiff_norm.csv`
- `Honolulu_paydiff_norm.csv`
- `Bootstrap estimation_individual behaviour.ipynb`

2. Open `Bootstrap estimation_individual behaviour.ipynb` .
3. Import packages.
4. Run section *Top-bottom Data* to get

- Figure 7 p-values

- Left panel
  - Subsection *Dutch auction bids*
- Right panel
  - Subsection *Dutch stage bids*