**Reproducibility *Report for Maintenance optimization for capital goods when information is incomplete and environment-dependent* by *Ragnar Eggertsson, Rob Basten, and Geert-Jan van Houtum***

**1. Metadata**

Manuscript Title: Maintenance optimization for capital goods when information is incomplete and environment-dependent
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Authors: Ragnar Eggertsson, Rob Basten, Geert-Jan van Houtum

**2. Data availability**

____**X**_____ A. Either no data are used in this study or all data used are included in the main text or supplemental materials.

_____ B. The data used in this study is publically available at the following website* (please provide the website link).

_____ C. The data used in this study is not yet publically available but will be made publically available at the time of paper acceptance** or will be made publically available subject to an embargo period of ____ years, counting from the time of paper acceptance. If an embargo period is invoked, please explain the reason for embargo.

_____ D. The data used in this study is not and will not be made publically available due to the following reason(s). Please present the reason(s).

Note:
* One can place the data (and/or code) at his/her research website, a Github website, or any other publically accessible websites. We do expect the website holding the datasets/codesets to be stably and reliably accessible over long term. If one desires to place the data (and/or code) through IISE Transactions' repository service, please visit IISE Transactions website, go to "Instructions for authors," and then to "Checklist Items 9 and 10".

** The time of paper acceptance is the time when the Accepted Manuscript Online (AMO) version of the paper is published. This time is documented for every paper in IISE Transactions on the journal's website.

**3. Data use ethics**

_____**X**____ My choice in Section 2 is (A).

_____ I certify that the authors have the legitimate access to the data and that nothing in the provisions governing the use of the data prohibits the authors from using the data in this research.

**4. Computer code# availability**

_____ A. Either no computer code is used in this study or the settings used in software are fully described in the main text or supplemental materials.

_____ B. The computer code used in this study is publically available at the following website. (please provide the website link).

_____**X**___ C. The computer used in this study is not publically yet available but will be made publically available at the time of paper acceptance or will be made publically available subject to an embargo period of __0_ years, counting from the time of paper acceptance. Please describe where to make the data publically available. If an embargo period is invoked, please explain the reason for embargo.
*If the paper is accepted, we will decide on the best way to make the code available with the data-team of Eindhoven University of Technology.*

_____ D. The computer code used in this study is not and will not be made publically available due to the following reason(s). Please present the reason(s).

**Note:**
# If the authors run their code on a software platform (either commercial or freeware), the authors do not need to provide the software platform, but simply to provide one's own code.

## The location for making code available and the meaning of "the time of paper acceptance" follow what is explained in Section 2.

**5. Reproducibility**

**5.1 Computer and software environment**

- Please describe the computer hardware conditions and software environment on which the authors produce the results reported in the paper.

**5.2 Workflow**

- The authors please use the following table to provide the instructions on how to reproduce the results in the figures/tables of the paper.

- The table below is supposed to include each and every figure/table in the paper that is considered as a research output or used to support the research conclusions. Hand-drawn diagrams or flowcharts are excluded from the reproducibility workflow.

- If you choose Option D above, please certify the following statement.

____X_____ I certify that the authors have faithfully conducted the reproducibility tasks on their own computational devices and that the following table accurately documented the filenames used, the computational times of execution, and the outcomes.

The workflow is as follows. On a Linux operating system (it works on the Ubuntu 20.04 LTS operating system), run Generation_of_results.py with the solver, solvePOMDP (v0.0.1 linux version), by Erwin Walraven in the same folder (more precisely, in your current working directory). It can be downloaded from https://www.erwinwalraven.nl/solvepomdp/. After extraction, copy the entire folder, called `solvepomdp_linux' to the same folder as the code to be executed. Also add a new folder called log_entries to the folder containing Generation_of_results.py. In the config file of the solver set:
algorithmType=gip
valueFunctionTolerance=0.000001
timeLimit=1000000
epsilon=0.000001
acceleratedLPThreshold=200
acceleratedRolerance=0.0001
coefficientThreshold=0.000000001
The file Generation_of_results.py will modify the values valueFunctionTolerance and epsilon.
It is advisable to run this file on a high-performance computing platform. We used Intel Xeon Platinum P-8124 (Skylake) @ 3.0 GHz CPUs.
This outputs the file results.csv and the folder solvepomdp_linux/output/ now contains the policies found by the solver.
The folder solvepomdp_linux (containing the folder output) and results.csv should be placed in the same folder as analysis_of_results.py to generate figures 3 and 4 and the data for tables 1, 2 and 3.
The Python file Generation_of_results_for_value_of_information.py can be run locally, with the same set-up as Generation_of_results.py, and outputs results_information.csv. This file serves as the input for Analysis_of_results_for_value_of_information.py.
Similarly, Generation_of_Figure_5.py can be run locally to reproduce Figure 5.
We suggest placing Generation_of_results.py, Generation_of_results_for_value_of_information.py, and Generation_of_Figure_5.py in distinct folders, each together with a copy of the solver, to avoid one file overwriting the results of another.

We also supply the files results.csv, results_information.csv and the solvepomdp_linux files with the computed policies.

| **Which results to reproduce** | **Data File** | **Code File** | **Expected output** | **Run time at the above-specified computer conditions** |
|---|---|---|---|---|
| Figure 3, Figure 4, Table 1, Table 2 | results.csv, solvepomdp_lin | analysis_of_results.py | 2 Figures, data for 2 | <1s |

| | | | | |
|---|---|---|---|---|
| | ux (folder) | | tables. | |
| Table 3 | results_information.csv | analysis_of_results_for_value_of_information.py | Data for 1 table | <1s |
| results.cvs | - | Generation_of_results.py | Numerical experiment | 148 CPU hours |
| results_information.csv | - | Generation_of_results_for_value_of_information.py | Small experiment for appendix | 3 min. |
| Figure 5 | - | Generation_of_Figure_5.py | Figure 5, data relevant to Appendix A.11 | 6.3 hours. |