Homework 5
Graph Spectra

André Silva - Jérémy Navarro

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1 Overview

In this homework, we implemented the Ja-Be-Ja algorithm by completing the provided code, as well as performed experiments using three different graphs.

Information about the structure of the project, as well as instructions on how to run it follow:

```
$ unzip homework5.zip
$ ./compile.sh
$ ./run.sh --graph <path-to-graph>
$ ./plot.sh <path-to-output>
```

The project is composed by:

- `src`: Source folder of the Maven project

- `pom.xml`: pom file of the Maven project

- `compile.sh`: Script to compile the project

- `run.sh`: Script to run the project

- `plot.sh`: Script to plot the results of the algorithm

2 Task I

2.1 Program

In Task 1, we completed the code in the file `Jabeja.java`, namely the functions `sampleAndSwap`, and `findPartner`.

2.2 Results

We then ran the program for three graphs, `3elt`, `add20`, and the Twitter graph. The results can be found in the following figures.
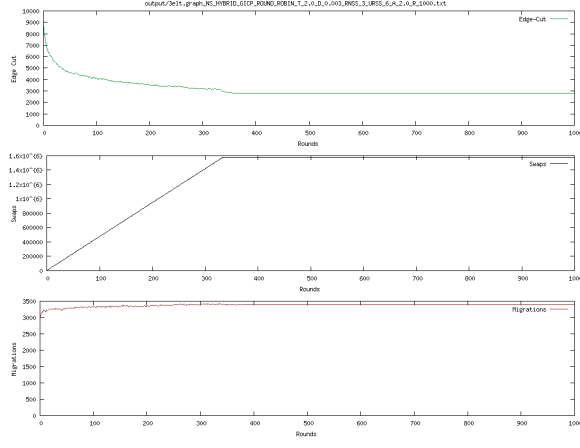
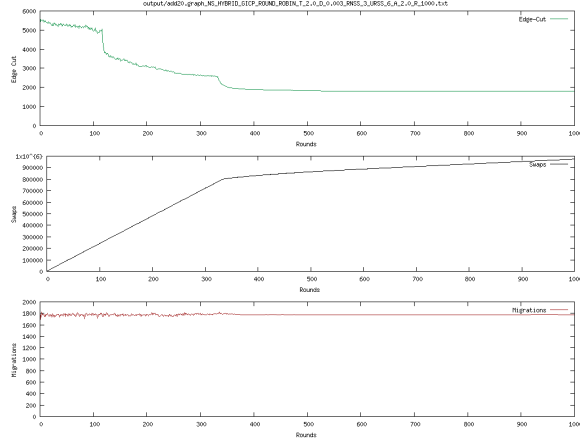Figure 1: Result of Ja-Be-Ja for `3elt` ($T = 2, \delta = 0.003$)

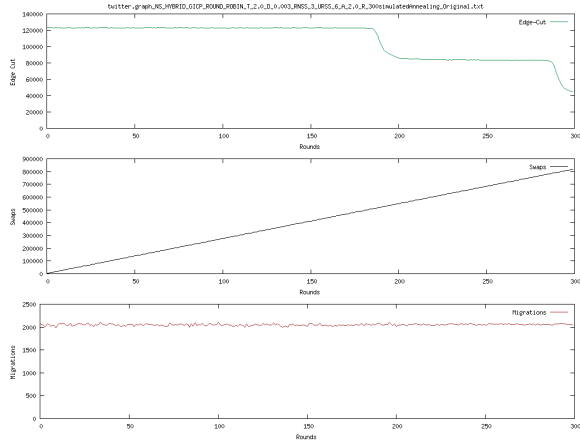Figure 2: Result of Ja-Be-Ja for `add20` ($T = 2, \delta = 0.003$)

Figure 3: Result of Ja-Be-Ja for the Twitter graph ($T = 2, \delta = 0.003$)

3   Task II

3.1   Program

In Task 2, we implemented the simulated annealing mechanism, in the function `saCoolDown`.

3.2   Results

We then ran, again, the program for the same three graphs, experimenting with different values of α, δ, and the effect of restarting the simulated annealing mechanism.

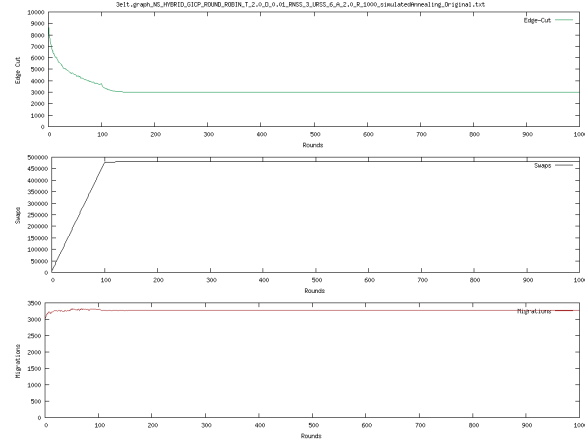|	Edge-Cut
Result of Ja-Be-Ja for `3elt` ($T = 2, \delta = 0.01$)	2982
Result of Ja-Be-Ja for `3elt` ($T = 2, \delta = 0.003$)	2788
Result of Ja-Be-Ja (w/ simulated annealing) for `3elt` ($T = 1, \alpha = 0.3$)	3199
Result of Ja-Be-Ja (w/ simulated annealing) for `3elt` ($T = 1, \alpha = 0.5$)	2970
Result of Ja-Be-Ja (w/ restart) for `3elt` ($T = 1, \alpha = 0.5$)	2646
Result of Ja-Be-Ja (w/ simulated annealing) for `add20` ($T = 1, \alpha = 0.3$)	1938
Result of Ja-Be-Ja (w/ simulated annealing) for `add20` ($T = 1, \alpha = 0.5$)	1953
Result of Ja-Be-Ja (w/ restart) for `add20` ($T = 1, \alpha = 0.5$)	1898
Result of Ja-Be-Ja (w/ simulated annealing) for Twitter graph ($T = 1, \alpha = 0.3$)	40952
Result of Ja-Be-Ja (w/ simulated annealing) for Twitter graph ($T = 1, \alpha = 0.5$)	42079
Result of Ja-Be-Ja (w/ restart) for Twitter graph ($T = 1, \alpha = 0.5$)	41013

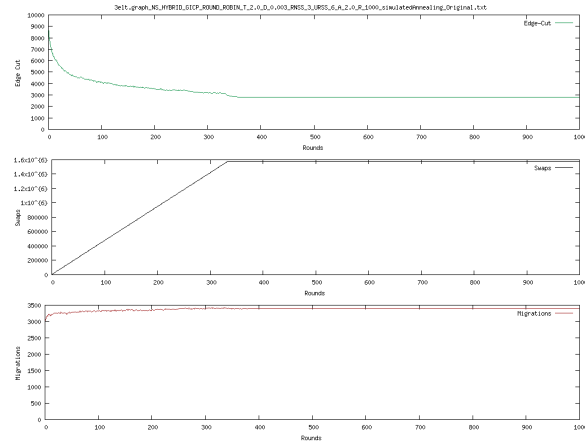Figure 4: Result of Ja-Be-Ja for `3elt` ($T = 2, \delta = 0.01$)

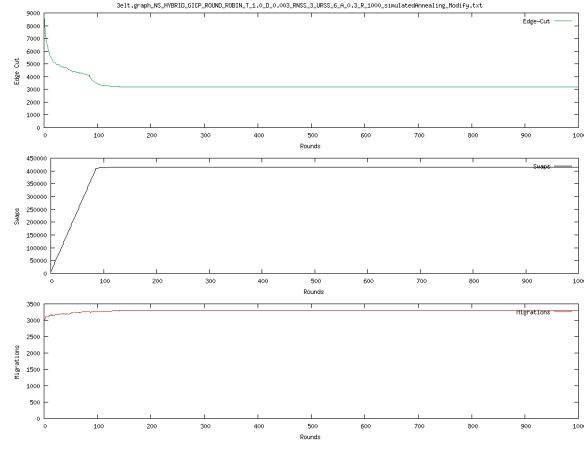Figure 5: Result of Ja-Be-Ja for `3elt` ($T = 2, \delta = 0.003$)

Figure 6: Result of Ja-Be-Ja (w/ simulated annealing) for `3elt` ($T = 1, \alpha = 0.3$)
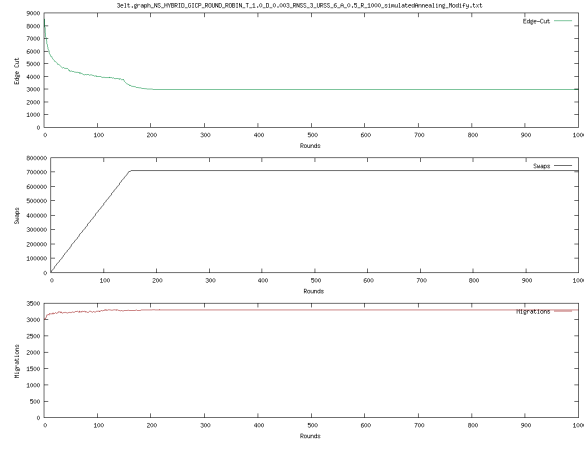

Figure 7: Result of Ja-Be-Ja (w/ simulated annealing) for `3elt` ($T = 1, \alpha = 0.5$)
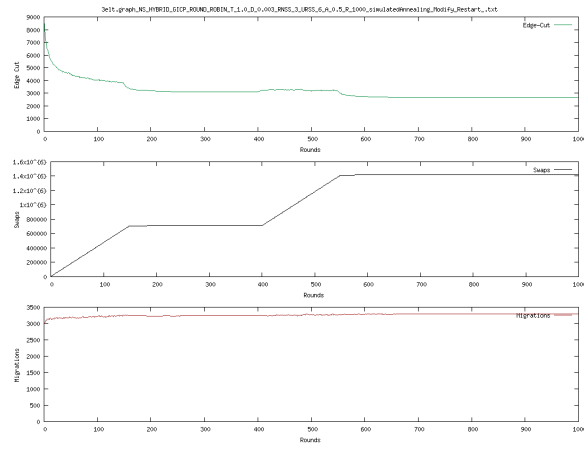

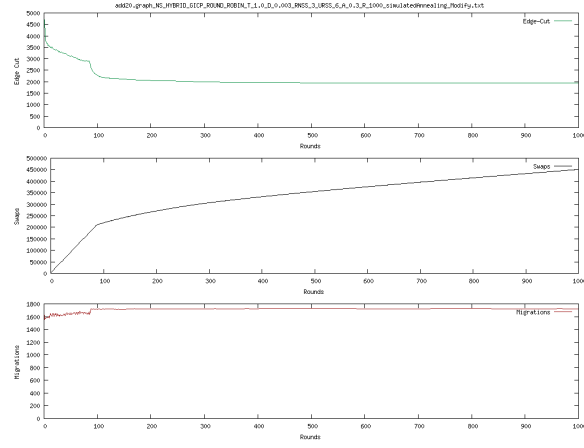Figure 8: Result of Ja-Be-Ja (w/ restart) for `3elt` ($T = 2, \alpha = 0.5$)

Figure 9: Result of Ja-Be-Ja (w/ simulated annealing) for `add20` ($T = 1, \alpha = 0.3$)
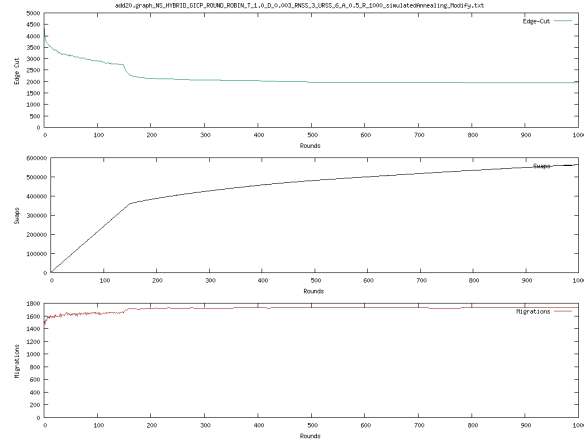

Figure 10: Result of Ja-Be-Ja (w/ simulated annealing) for `add20` ($T = 1, \alpha = 0.5$)
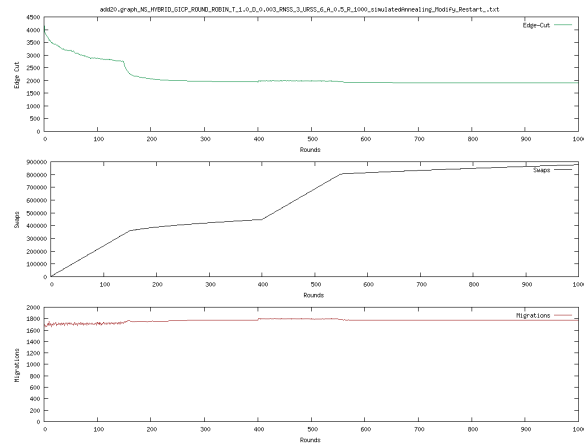

Figure 11: Result of Ja-Be-Ja (w/ restart) for `add20` ($T = 1, \alpha = 0.5$)
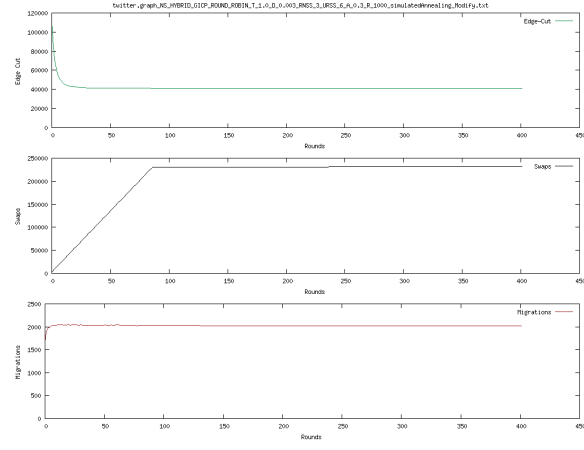
Figure 12: Result of Ja-Be-Ja (w/ simulated annealing) for Twitter graph ($T = 1, \alpha = 0.3$)
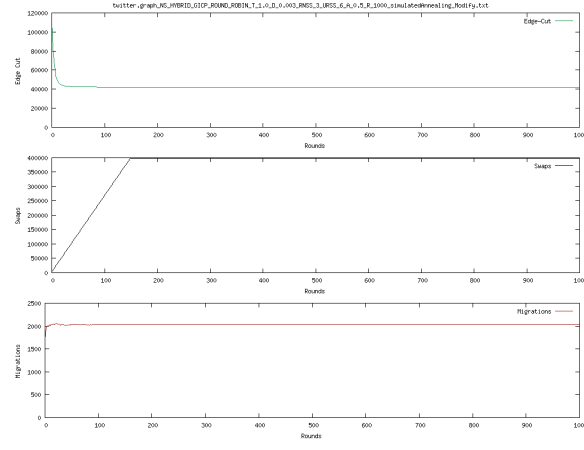

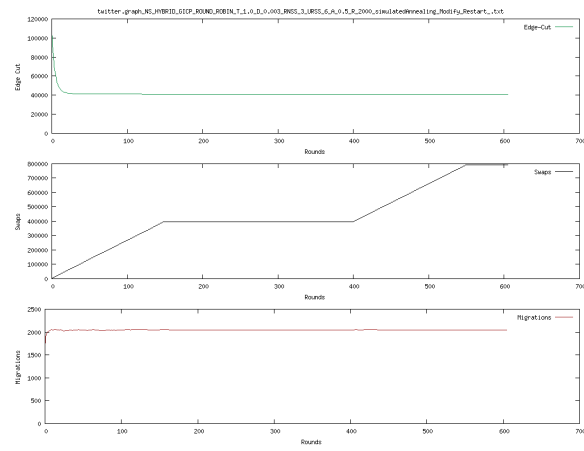Figure 13: Result of Ja-Be-Ja (w/ simulated annealing) for Twitter graph ($T = 1, \alpha = 0.5$)

Figure 14: Result of Ja-Be-Ja (w/ restart) for Twitter graph ($T = 1, \alpha = 0.5$)