

CS542 Project 4 Undo/Redo Logging

Xiaoyan Sun & Shi Wang

1. Key Assumptions

In this project, we use the undo/redo logging scheme to keep track on and restore data from our database file city.csv and country.csv

The key assumptions are

- ✚ The project is divided into two parts: updating the original data (population up 2%), generating a log file in the process, and redoing the operations on copied files (city 2.csv and country 2.csv) using the existing log file
- ✚ A 2% of increase is introduced to the population attributes on every tuple in the two relations stored in city.csv and country.csv by the update classes. The whole process is considered to be one transaction.
- ✚ We give the transaction name “T”, and the variable changed in the format $\langle T, v, \text{old}, \text{new} \rangle$ is given by the ID of the tuple of relation city, and the Code of the tuple of relation country.
- ✚ Log statement is generated in memory after each tuple is operated on during the update, and is flushed to a log file after all tuples are done, after relations are outputted back to disk (to the .csv file), and after a $\langle \text{COMMIT } T \rangle$ is seen. So log is only flushed once.
- ✚ A testRelation class is included to test whether the two relations city.csv and city 2 .csv after redo contain the same value in population

2. test and result

2.1 the update operator

The log file for updating the relation city

```
<START T>
<T,1,1780000,1815600>
<T,2,237500,242250>
<T,3,186800,190536>
<T,4,127800,130356>
<T,5,731200,745824>
<T,6,593321,605187>
<T,7,440900,449718>
<T,8,234323,239009>
<T,9,201843,205879>
<T,10,193238,197102>
<T,11,172701,176155>
<T,12,160398,163605>
<T,13,153491,156560>
<T,14,152463,155512>
<T,15,149544,152534>
<T,16,148772,151747>
<T,17,142465,145314>
<T,18,138020,140780>
<T,19,135621,138333>
<T,20,129170,131753>
<T,21,126270,128795>
<T,22,122087,124528>
<T,23,119811,122207>
<T,24,117196,119539>
<T,25,110722,112936>
<T,26,110214,112418>
<T,27,105853,107970>
<T,28,105819,107935>
<T,29,101574,103605>
<T,30,95268,97173>
<T,4048,93994,95873>
<T,4049,93653,95526>
<T,4050,93357,95224>
<T,4051,92988,94847>
<T,4052,92864,94721>
<T,4053,92291,94136>
<T,4054,92256,94101>
<T,4055,92040,93880>
<T,4056,91799,93634>
<T,4057,91762,93597>
<T,4058,91238,93062>
<T,4059,91213,93037>
<T,4060,91084,92905>
<T,4061,90555,92366>
<T,4062,89447,91235>
<T,4063,89408,91196>
<T,4064,89293,91078>
<T,4065,89089,90870>
<T,4066,89063,90844>
<T,4067,13000,13260>
<T,4068,1410000,1438200>
<T,4069,621742,634176>
<T,4070,274912,280410>
<T,4071,164362,167649>
<T,4072,131367,133994>
<T,4073,128037,130597>
<T,4074,353632,360704>
<T,4075,123175,125638>
<T,4076,119401,121789>
<T,4077,113901,116179>
<T,4078,100231,102235>
<T,4079,92020,93860>
<COMMIT T>
```

The log file after updating relation country

```

<START T>
<T, 'ABW', 103000, 105060>
<T, 'AFG', 22720000, 23174400>
<T, 'AGO', 12878000, 13135560>
<T, 'AIA', 8000, 8160>
<T, 'ALB', 3401200, 3469224>
<T, 'AND', 78000, 79560>
<T, 'ANT', 217000, 221340>
<T, 'ARE', 2441000, 2489820>
<T, 'ARG', 37032000, 37772640>
<T, 'ARM', 3520000, 3590400>
<T, 'ASM', 68000, 69360>
<T, 'ATA', 0, 0>
<T, 'ATF', 0, 0>
<T, 'ATG', 68000, 69360>
<T, 'AUS', 18886000, 19263720>
<T, 'AUT', 8091800, 8253636>
<T, 'AZE', 7734000, 7888680>
<T, 'BDI', 6695000, 6828900>
<T, 'BEL', 10239000, 10443780>
<T, 'BEN', 6097000, 6218940>
<T, 'BFA', 11937000, 12175740>
<T, 'BGD', 129155000, 131738100>
<T, 'BGR', 8190900, 8354718>
<T, 'BHR', 617000, 629340>
<T, 'BHS', 307000, 313140>
<T, 'BIH', 3972000, 4051440>
<T, 'BLR', 10236000, 10440720>
<T, 'BLZ', 241000, 245820>
<T, 'TUN', 9586000, 9777720>
<T, 'TUR', 66591000, 67922820>
<T, 'TUV', 12000, 12240>
<T, 'TWN', 22256000, 22701120>
<T, 'TZA', 33517000, 34187340>
<T, 'UGA', 21778000, 22213560>
<T, 'UKR', 50456000, 51465120>
<T, 'UMI', 0, 0>
<T, 'URY', 3337000, 3403740>
<T, 'USA', 278357000, 283924140>
<T, 'UZB', 24318000, 24804360>
<T, 'VAT', 1000, 1020>
<T, 'VCT', 114000, 116280>
<T, 'VEN', 24170000, 24653400>
<T, 'VGB', 21000, 21420>
<T, 'VIR', 93000, 94860>
<T, 'VNM', 79832000, 81428640>
<T, 'VUT', 190000, 193800>
<T, 'WLF', 15000, 15300>
<T, 'WSM', 180000, 183600>
<T, 'YEM', 18112000, 18474240>
<T, 'YUG', 10640000, 10852800>
<T, 'ZAF', 40377000, 41184540>
<T, 'ZMB', 9169000, 9352380>
<T, 'ZWE', 11669000, 11902380>
<COMMIT T>

```

2.2 the redo operator

The city relation after updating (left) and the city 2 relation after redo (right)

ID,Name,CountryCode,District,Population	ID,Name,CountryCode,District,Population
1, 'Kabul', 'AFG', 'Kabul', 1815600	1, 'Kabul', 'AFG', 'Kabul', 1815600
2, 'Qandahar', 'AFG', 'Qandahar', 242250	2, 'Qandahar', 'AFG', 'Qandahar', 242250
3, 'Herat', 'AFG', 'Herat', 190536	3, 'Herat', 'AFG', 'Herat', 190536
4, 'Mazar-e-Sharif', 'AFG', 'Balkh', 130356	4, 'Mazar-e-Sharif', 'AFG', 'Balkh', 130356
5, 'Amsterdam', 'NLD', 'Noord-Holland', 745824	5, 'Amsterdam', 'NLD', 'Noord-Holland', 745824
6, 'Rotterdam', 'NLD', 'Zuid-Holland', 605187	6, 'Rotterdam', 'NLD', 'Zuid-Holland', 605187
7, 'Haag', 'NLD', 'Zuid-Holland', 449718	7, 'Haag', 'NLD', 'Zuid-Holland', 449718
8, 'Utrecht', 'NLD', 'Utrecht', 239009	8, 'Utrecht', 'NLD', 'Utrecht', 239009
9, 'Eindhoven', 'NLD', 'Noord-Brabant', 205879	9, 'Eindhoven', 'NLD', 'Noord-Brabant', 205879
10, 'Tilburg', 'NLD', 'Noord-Brabant', 197102	10, 'Tilburg', 'NLD', 'Noord-Brabant', 197102
11, 'Groningen', 'NLD', 'Groningen', 176155	11, 'Groningen', 'NLD', 'Groningen', 176155
12, 'Breda', 'NLD', 'Noord-Brabant', 163605	12, 'Breda', 'NLD', 'Noord-Brabant', 163605
13, 'Apeldoorn', 'NLD', 'Gelderland', 156560	13, 'Apeldoorn', 'NLD', 'Gelderland', 156560
14, 'Nijmegen', 'NLD', 'Gelderland', 155512	14, 'Nijmegen', 'NLD', 'Gelderland', 155512
15, 'Enschede', 'NLD', 'Overijssel', 152534	15, 'Enschede', 'NLD', 'Overijssel', 152534
16, 'Haarlem', 'NLD', 'Noord-Holland', 151747	16, 'Haarlem', 'NLD', 'Noord-Holland', 151747
17, 'Almere', 'NLD', 'Flevoland', 145314	17, 'Almere', 'NLD', 'Flevoland', 145314
18, 'Arnhem', 'NLD', 'Gelderland', 140780	18, 'Arnhem', 'NLD', 'Gelderland', 140780
19, 'Zaanstad', 'NLD', 'Noord-Holland', 138333	19, 'Zaanstad', 'NLD', 'Noord-Holland', 138333
20, 's-Hertogenbosch', 'NLD', 'Noord-Brabant', 131753	20, 's-Hertogenbosch', 'NLD', 'Noord-Brabant', 131753
21, 'Amersfoort', 'NLD', 'Utrecht', 128795	21, 'Amersfoort', 'NLD', 'Utrecht', 128795
22, 'Maastricht', 'NLD', 'Limburg', 124528	22, 'Maastricht', 'NLD', 'Limburg', 124528
23, 'Dordrecht', 'NLD', 'Zuid-Holland', 122207	23, 'Dordrecht', 'NLD', 'Zuid-Holland', 122207
24, 'Leiden', 'NLD', 'Zuid-Holland', 119539	24, 'Leiden', 'NLD', 'Zuid-Holland', 119539
25, 'Haarlemmermeer', 'NLD', 'Noord-Holland', 112936	25, 'Haarlemmermeer', 'NLD', 'Noord-Holland', 112936
26, 'Zoetermeer', 'NLD', 'Zuid-Holland', 112418	26, 'Zoetermeer', 'NLD', 'Zuid-Holland', 112418
27, 'Emmen', 'NLD', 'Drenthe', 107970	27, 'Emmen', 'NLD', 'Drenthe', 107970
28, 'Zwolle', 'NLD', 'Overijssel', 107935	28, 'Zwolle', 'NLD', 'Overijssel', 107935

The country relation after updating (top) and the country 2 relation after redo (bottom)

```
Code,Name,Continent,Region,SurfaceArea,IndepYear,Population,LifeExpectancy,GNP,GNPold,LocalName,GovernmentForm,HeadOfState,Capital,Code2
'ABW','Aruba','North America','Caribbean',193.00,NULL,105060,78.4,828.00,793.00,'Aruba','Nonmetropolitan Territory of The
Netherlands','Beatrix',129,'AW'
'AFG','Afghanistan','Asia','Southern and Central Asia',652090.00,1919,23174400,45.9,5976.00,NULL,'Afganistan/Afqanestan','Islamic
Emirate','Mohammad Omar',1,'AF'
'AGO','Angola','Africa','Central Africa',1246700.00,1975,13135560,38.3,6648.00,7984.00,'Angola','Republic','José Eduardo dos Santos',56,'AO'
'AIA','Anguilla','North America','Caribbean',96.00,NULL,8160,76.1,63.20,NULL,'Anguilla','Dependent Territory of the UK','Elisabeth II',62,'AI'
'ALB','Albania','Europe','Southern Europe',28748.00,1912,3469224,71.6,3205.00,2500.00,'Shqipëria','Republic','Rexhep Mejdani',34,'AL'
'AND','Andorra','Europe','Southern Europe',468.00,1278,79560,83.5,1630.00,NULL,'Andorra','Parliamentary Coprincipality','',55,'AD'
'ANT','Netherlands Antilles','North America','Caribbean',800.00,NULL,221340,74.7,1941.00,NULL,'Nederlandse Antillen','Nonmetropolitan
Territory of The Netherlands','Beatrix',33,'AN'
'ARE','United Arab Emirates','Asia','Middle East',83600.00,1971,2489820,74.1,37966.00,36846.00,'Al-Imarat al-`Arabiya al-Muttahida','Emirate
Federation','Zayid bin Sultan al-Nahayan',65,'AE'
'ARG','Argentina','South America','South America',2780400.00,1816,37772640,75.1,340238.00,323310.00,'Argentina','Federal Republic','Fernando
de la Rúa',69,'AR'
'ARM','Armenia','Asia','Middle East',29800.00,1991,3590400,66.4,1813.00,1627.00,'Hajastan','Republic','Robert Kotšarjan',126,'AM'
'ASM','American Samoa','Oceania','Polynesia',199.00,NULL,69360,75.1,334.00,NULL,'Amerika Samoa','US Territory','George W. Bush',54,'AS'
'ATA','Antarctica','Antarctica','Antarctica',13120000.00,NULL,0,NULL,0.00,NULL,'-',',Co-administrated','',NULL,'AQ'
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Code,Name,Continent,Region,SurfaceArea,IndepYear,Population,LifeExpectancy,GNP,GNPold,LocalName,GovernmentForm,HeadOfState,Capital,Code2
'ABW','Aruba','North America','Caribbean',193.00,NULL,105060,78.4,828.00,793.00,'Aruba','Nonmetropolitan Territory of The
Netherlands','Beatrix',129,'AW'|
'AFG','Afghanistan','Asia','Southern and Central Asia',652090.00,1919,23174400,45.9,5976.00,NULL,'Afganistan/Afqanestan','Islamic
Emirate','Mohammad Omar',1,'AF'
'AGO','Angola','Africa','Central Africa',1246700.00,1975,13135560,38.3,6648.00,7984.00,'Angola','Republic','José Eduardo dos Santos',56,'AO'
'AIA','Anguilla','North America','Caribbean',96.00,NULL,8160,76.1,63.20,NULL,'Anguilla','Dependent Territory of the UK','Elisabeth II',62,'AI'
'ALB','Albania','Europe','Southern Europe',28748.00,1912,3469224,71.6,3205.00,2500.00,'Shqipëria','Republic','Rexhep Mejdani',34,'AL'
'AND','Andorra','Europe','Southern Europe',468.00,1278,79560,83.5,1630.00,NULL,'Andorra','Parliamentary Coprincipality','',55,'AD'
'ANT','Netherlands Antilles','North America','Caribbean',800.00,NULL,221340,74.7,1941.00,NULL,'Nederlandse Antillen','Nonmetropolitan
Territory of The Netherlands','Beatrix',33,'AN'
'ARE','United Arab Emirates','Asia','Middle East',83600.00,1971,2489820,74.1,37966.00,36846.00,'Al-Imarat al-`Arabiya al-Muttahida','Emirate
Federation','Zayid bin Sultan al-Nahayan',65,'AE'
'ARG','Argentina','South America','South America',2780400.00,1816,37772640,75.1,340238.00,323310.00,'Argentina','Federal Republic','Fernando
de la Rúa',69,'AR'
'ARM','Armenia','Asia','Middle East',29800.00,1991,3590400,66.4,1813.00,1627.00,'Hajastan','Republic','Robert Kotšarjan',126,'AM'
'ASM','American Samoa','Oceania','Polynesia',199.00,NULL,69360,75.1,334.00,NULL,'Amerika Samoa','US Territory','George W. Bush',54,'AS'
'ATA','Antarctica','Antarctica','Antarctica',13120000.00,NULL,0,NULL,0.00,NULL,'-',',Co-administrated','',NULL,'AQ'
```

The relation after updating and the relation after redo have the same value of population.