CSC 320 Project

**Sudoku SAT Solver**

April 4, 2017

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| --- | --- | --- | --- | --- |
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**Introduction**

For our Sudoku project, we decided to code the SAT-solver using the Java programming language. Our two pieces of code, sat2sud and sud2sat, will take SAT-encoded inputs and output solved puzzles, and taken Sudoku puzzle and output a SAT-encoded file respectively.

Since we have a large group with five members, we decided to divvy up the tasks of this project to various members. Teams of two worked on the two main pieces of code and then the rest worked on the report and README file. A breakdown of this information can be found in our “Contributions” section.

## Deliverables

1. sud2sat.java
2. sat2sud.java
3. README.txt
4. csc320projectreport.docx

**How to use:**

In Terminal:

Type in : javac sud2sat.java

java sud2sat input.txt

minisat inputSAT.txt outputSAT.txt

javac sat2sud.java

java sat2sud outputSAT.txt

## Solved Puzzles

483921657

967345821

251876493

548132976

729564138

136798245

372689514

814253769

695417382(0.004s)

245981376

169273584

837564219

976125438

000000000

402706000

301007040

720040060

004010003(0.004s)

462831957

795426183

381795426

173984265

659312748

248567319

926178534

834259671

517643892(0s)

137256849

928314567

465897312

673542981

819673254

542189736

256731498

391428675

784965123(0.004s)

523816749

784593126

691472835

239145687

457268913

168937254

342789561

915624378

876351492(0.004s)

176923584

524817639

893654271

957348162

638192457

412765398

265489713

781236945

349571826(0s)

143986257

679425381

285731694

962354178

357618942

418279563

821567439

796143825

534892716(0.004s)

487156932

362498751

915372864

846519273

593724186

271863549

124685397

738941625

659237418(0s)

814976532

659123478

732854169

948265317

275341896

163798245

391682754

587439621

426517983(0.004s)

761928453

925743168

438615927

357461289

894372615

216589374

689154732

142837596

573296841(0.004s)

976125438

158436927

423879156

234761895

867952314

519384762

782513649

395647281

641298573(0.004s)

962341758

148975623

573268149

321694875

487512936

695837412

834726591

216459387

759183264(0s)

397681524

645279813

218534976

823956741

169742358

754318692

472893165

531467289

986125437(0.004s)

639218457

471539268

825674139

564823791

793451826

218796345

352987614

186345972

947162583(0.008s)

697128345

428635197

315479682

531246978

286397451

974581263

149852736

752963814

863714529(0s)

361725948

587964213

492831657

638259471

174683592

259147836

746392185

923518764

815476329(0.004s)

359867124

648312597

712549836

876924351

524731968

193685472

931476285

465298713

287153649(0.004s)

786945312

219863457

534271869

165482973

327619548

498537126

951728634

842356791

673194285(0.004s)

743512986

589346217

126987345

934251768

671498532

852763491

398675124

417829653

265134879(0.004s)

782614359

439825176

651937428

293471865

568392714

147568293

326749581

975183642

814256937(0.004s)

428531796

365947182

971268435

214896573

697453218

583172964

849615327

752389641

136724859(0.004s)

425781936

178369524

369524187

894157362

652843791

713692845

987216453

536478219

241935678(0.004s)

348267951

571943628

269185374

697351482

123874596

854629137

415798263

982436715

736512849(0.004s)

124986735

867435912

395712684

478359261

259861347

631274598

712698453

983547126

546123879(0.004s)

361524789

789361425

524879361

893157642

412683597

657942138

148796253

235418976

976235814(0.004s)

581479263

329156847

647328159

956731428

238964571

714582936

172695384

893247615

465813792(0.004s)

387256419

469781325

512439867

123548976

758963241

694127583

835674192

271895634

946312758(0.004s)

345871269

279653184

861429537

197346852

452718396

683592741

738264915

516937428

924185673(0.004s)

235761489

419328576

867549213

746135928

521896734

983472651

394287165

652913847

178654392(0.004s)

298175643

657394128

134286579

821649735

573821496

469753281

312468957

785912364

946537812(0.004s)

761543289

832791645

549628137

374215968

128936574

695487321

417369852

953872416

286154793(0.004s)

132649785

758213649

964785123

543897216

276531894

891426537

619378452

327154968

485962371(0.004s)

698173542

354628179

172549368

531897426

946312857

827456913

765931284

213784695

489265731(0s)

852716943

197843652

463925187

278634591

645179328

931582476

786491235

314258769

529367814(0.004s)

453218796

629753481

178496532

796582314

314967825

285134679

542879163

937641258

861325947(0.004s)

516289347

849173256

732465918

698317524

327954861

154826739

961732485

275648193

483591672(0s)

945681723

781234965

326759184

269175348

138942576

574863219

457326891

612598437

893417652(0.004s)

365942871

128756493

974813562

819435627

537268149

642179358

296384715

753691284

481527936(0.004s)

134587296

278169354

695234817

359816472

821473569

746925183

917348625

462751938

583692741(0.004s)

193672485

462358971

785914623

538296714

674135298

219487356

826741539

941523867

357869142(0.004s)

814976532

659123478

732854169

948265317

275341896

163798245

391682754

587439621

426517983(0.004s)

384567921

126439785

759821346

563798214

847312659

912645873

231974568

495286137

678153492(0.004s)

469158372

712463859

538297641

927634518

385719426

146582793

653941287

294876135

871325964(0.004s)

316549278

987321645

452678931

594236817

238417569

671985324

845162793

129753486

763894152(0.004s)

586127943

723469851

491853267

135974628

279618534

648532179

917246385

352781496

864395712(0.004s)

954213687

617548923

832796541

763851294

128974365

549362178

281637459

475129836

396485712(0.004s)

159743862

276589431

348612759

624978315

917235684

583164297

435821976

861497523

792356148(0s)

861357294

597482361

432619785

916275843

358964127

274138956

789541632

143826579

625793418(0.004s)

294863517

715429638

863751492

152947863

479386251

638512974

986134725

521678349

347295186(0s)

351286497

492157638

786934512

275469183

938521764

614873259

829645371

163792845

547318926(0.004s)

## Time Data

* Time required to solve each puzzle: (see after each solved puzzle)
* Average time to solve puzzles : 0.004s

## References

[1] Lynce, Inês, and Joël Ouaknine. "Sudoku as a SAT Problem." In *ISAIM*. 2006.

[2] Weber, Tjark. "A SAT-based Sudoku solver." In *LPAR*, pp. 11-15. 2005.

## Contributions

|  |  |
| --- | --- |
| **Name** | **Contributions** |
| Derrick Chen | sat2sud code |
| Tristan Douville | Report, README |
| Ella Guan | sud2sat code |
| Yilun Liu | sat2sud code |
| Zhengtang Wang | sud2sat code |