**Dhananjay Suresh**

**EM Algorithm Report**

**4/7/16**

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**Analysis:**

1. **Do multiple starting points help in finding a better solution?**  
   Changing the starting points does affect the number of iterations the algorithm processes. In the provided results, the changes to the original provided parameters increased the number of iterations significantly for the 50% and 70% missing dataset from 9 iterations for both to 14 and 13 respectively. However, changing the parameters gave very similar probabilities compared to different parameter solutions when only part of the dataset was missing. Only with the 100% missing dataset was there a significant difference in final probabilities. With 100% missing data the algorithm resulted in different final probabilities between different starting parameters.
2. **Do some of the different solutions have the same likelihood scores?**Changing the starting points did not effect the likelihood scores. The difference in likelihood scores depended on how much of the data was missing. With more data missing from the dataset, there was a higher likelihood score. For example 10% missing data converged on 45.969 while the 100% dataset converged on a likelihood score of 120.337.
3. **How does the data missing rate affect your algorithm and the results?**Missing data effected the likelihood depending on how much of the data was missing. With more missing data, the likelihood score increased. The missing data only effected the final probabilities when all the data was missing. With partial missing data, the algorithm resulted in very similar probability values for gender, weight given gender and height given gender. The biggest difference between changing starting parameters came with the 100% missing dataset. There was a significant difference between algorithms running different parameters when the data was completely missing.

**Threshold = 0.001**

**Starting parameters:**

|  |  |
| --- | --- |
| Male | Female |
| 0.7 | 0.3 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.8 | 0.2 |
| Female | 0.4 | 0.6 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.7 | 0.3 |
| Female | 0.3 | 0.7 |

**Changed parameters:**

|  |  |
| --- | --- |
| Male | Female |
| 0.8 | 0.2 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.7 | 0.3 |
| Female | 0.2 | 0.8 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.9 | 0.1 |
| Female | 0.3 | 0.7 |

**Final parameters for 10% missing original:**

|  |  |
| --- | --- |
| Male | Female |
| 0.642 | 0.358 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.794 | 0.206 |
| Female | 0.349 | 0.651 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.662 | 0.338 |
| Female | 0.265 | 0.735 |

**Final parameters for 10% missing changed:**

**Changed parameters:**

|  |  |
| --- | --- |
| Male | Female |
| 0.642 | 0.358 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.794 | 0.206 |
| Female | 0.349 | 0.651 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.662 | 0.338 |
| Female | 0.265 | 0.735 |

**Final parameters for 30% missing original:**

|  |  |
| --- | --- |
| Male | Female |
| 0.682 | 0.318 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.786 | 0.214 |
| Female | 0.375 | 0.625 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.651 | 0.349 |
| Female | 0.35 | 0.65 |

**Final parameters for 30% missing changed:**

|  |  |
| --- | --- |
| Male | Female |
| 0.682 | 0.318 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.786 | 0.214 |
| Female | 0.375 | 0.625 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.651 | 0.349 |
| Female | 0.35 | 0.65 |

**Final parameters for 50% missing original:**

|  |  |
| --- | --- |
| Male | Female |
| 0.663 | 0.337 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.744 | 0.256 |
| Female | 0.48 | 0.52 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.688 | 0.312 |
| Female | 0.338 | 0.662 |

**Final parameters for 50% missing changed:**

|  |  |
| --- | --- |
| Male | Female |
| 0.663 | 0.337 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.744 | 0.256 |
| Female | 0.48 | 0.52 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.688 | 0.312 |
| Female | 0.338 | 0.662 |

**Final parameters for 70% missing original:**

|  |  |
| --- | --- |
| Male | Female |
| 0.691 | 0.309 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.829 | 0.171 |
| Female | 0.427 | 0.573 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.658 | 0.342 |
| Female | 0.31 | 0.69 |

**Final parameters for 70% missing changed:**

|  |  |
| --- | --- |
| Male | Female |
| 0.691 | 0.309 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.829 | 0.171 |
| Female | 0.427 | 0.573 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.657 | 0.343 |
| Female | 0.31 | 0.69 |

**Final parameters for 100% missing original:**

|  |  |
| --- | --- |
| Male | Female |
| 0.697 | 0.303 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.797 | 0.203 |
| Female | 0.363 | 0.637 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.725 | 0.275 |
| Female | 0.296 | 0.704 |

**Final parameters for 100% missing changed:**

|  |  |
| --- | --- |
| Male | Female |
| 0.749 | 0.251 |

|  |  |  |
| --- | --- | --- |
| Gender | Weight>130 | Weight<130 |
| Male | 0.759 | 0.41 |
| Female | 0.386 | 0.614 |

|  |  |  |
| --- | --- | --- |
| Gender | Height>55 | Height<55 |
| Male | 0.736 | 0.264 |
| Female | 0.174 | 0.826 |

**Original Parameters (threshold = 0.001)**

**STARTING EM ALGORITHM FOR hw2dataset\_10.txt**

Iteration: 1

P(Male):0.644033653058 P(Female):0.355966346942

P(Weight>130|Male):0.793141734787 P(Weight>130|Female):0.348881382242

P(Height>55|Male):0.660990800253 P(Height>55|Female):0.264911784739

Likelihood: 45.9502228294

Iteration: 2

P(Male):0.642569147501 P(Female):0.357430852499

P(Weight>130|Male):0.794361885286 P(Weight>130|Female):0.348508137149

P(Height>55|Male):0.661846742552 P(Height>55|Female):0.264995878783

Likelihood: 45.9676499348

Iteration: 3

P(Male):0.642469527287 P(Female):0.357530472713

P(Weight>130|Male):0.794430889914 P(Weight>130|Female):0.348508368389

P(Height>55|Male):0.661916355437 P(Height>55|Female):0.264981363126

Likelihood: 45.9686984181

Iteration: 4

P(Male):0.642462471474 P(Female):0.357537528526

P(Weight>130|Male):0.794434863373 P(Weight>130|Female):0.348510028488

P(Height>55|Male):0.661921764906 P(Height>55|Female):0.264979476104

!!!Convergence!!!

Likelihood: 45.9687560172

**STARTING EM ALGORITHM FOR hw2dataset\_30.txt**

Iteration: 1

P(Male):0.684629242499 P(Female):0.315370757501

P(Weight>130|Male):0.782536926988 P(Weight>130|Female):0.378133779408

P(Height>55|Male):0.658574326818 P(Height>55|Female):0.330153494021

Likelihood: 61.6409517733

Iteration: 2

P(Male):0.683223402988 P(Female):0.316776597012

P(Weight>130|Male):0.78410636685 P(Weight>130|Female):0.376543535292

P(Height>55|Male):0.652958830705 P(Height>55|Female):0.343722505708

Likelihood: 61.5211055364

Iteration: 3

P(Male):0.682313998676 P(Female):0.317686001324

P(Weight>130|Male):0.785096073545 P(Weight>130|Female):0.375584565318

P(Height>55|Male):0.651488712998 P(Height>55|Female):0.347765185377

Likelihood: 61.4906763238

Iteration: 4

P(Male):0.681878064849 P(Female):0.318121935151

P(Weight>130|Male):0.78556306507 P(Weight>130|Female):0.375144761134

P(Height>55|Male):0.651081220329 P(Height>55|Female):0.349054828206

Likelihood: 61.4824370282

Iteration: 5

P(Male):0.681689723297 P(Female):0.318310276703

P(Weight>130|Male):0.785762963116 P(Weight>130|Female):0.374959502825

P(Height>55|Male):0.65096029818 P(Height>55|Female):0.349492500238

Likelihood: 61.4800409546

Iteration: 6

P(Male):0.681612164122 P(Female):0.318387835878

P(Weight>130|Male):0.785844801387 P(Weight>130|Female):0.374884373121

P(Height>55|Male):0.650921804723 P(Height>55|Female):0.349648345394

!!!Convergence!!!

Likelihood: 61.4792902128

**STARTING EM ALGORITHM FOR hw2dataset\_50.txt**

Iteration: 1

P(Male):0.676463149697 P(Female):0.323536850303

P(Weight>130|Male):0.76046075273 P(Weight>130|Female):0.434498647853

P(Height>55|Male):0.687098008574 P(Height>55|Female):0.325167030808

Likelihood: 79.5880139681

Iteration: 2

P(Male):0.669592491391 P(Female):0.330407508609

P(Weight>130|Male):0.751678915696 P(Weight>130|Female):0.45907383507

P(Height>55|Male):0.686252867077 P(Height>55|Female):0.334405938518

Likelihood: 79.3139721865

Iteration: 3

P(Male):0.666034418699 P(Female):0.333965581301

P(Weight>130|Male):0.747786156791 P(Weight>130|Female):0.469954661612

P(Height>55|Male):0.68666924292 P(Height>55|Female):0.337324132369

Likelihood: 79.1976459726

Iteration: 4

P(Male):0.664258733152 P(Female):0.335741266848

P(Weight>130|Male):0.745986972528 P(Weight>130|Female):0.474983728328

P(Height>55|Male):0.687189552419 P(Height>55|Female):0.338142342586

Likelihood: 79.1468528287

Iteration: 5

P(Male):0.663397040965 P(Female):0.336602959035

P(Weight>130|Male):0.745124223427 P(Weight>130|Female):0.477377844474

P(Height>55|Male):0.687581384247 P(Height>55|Female):0.338263646269

Likelihood: 79.1244523563

Iteration: 6

P(Male):0.662992054605 P(Female):0.337007945395

P(Weight>130|Male):0.744693359212 P(Weight>130|Female):0.478547232873

P(Height>55|Male):0.687837934397 P(Height>55|Female):0.338178717137

Likelihood: 79.1145665222

Iteration: 7

P(Male):0.662810247835 P(Female):0.337189752165

P(Weight>130|Male):0.744468175814 P(Weight>130|Female):0.479133374743

P(Height>55|Male):0.687996375762 P(Height>55|Female):0.338055800746

Likelihood: 79.1102365753

Iteration: 8

P(Male):0.662734706554 P(Female):0.337265293446

P(Weight>130|Male):0.744344700302 P(Weight>130|Female):0.479435437361

P(Height>55|Male):0.688091754758 P(Height>55|Female):0.337946758956

Likelihood: 79.1083758156

Iteration: 9

P(Male):0.66270796032 P(Female):0.33729203968

P(Weight>130|Male):0.744273742651 P(Weight>130|Female):0.479595860732

P(Height>55|Male):0.688148704639 P(Height>55|Female):0.337862629846

!!!Convergence!!!

Likelihood: 79.1076067163

**STARTING EM ALGORITHM FOR hw2dataset\_70.txt**

Iteration: 1

P(Male):0.695428143958 P(Female):0.304571856042

P(Weight>130|Male):0.824700947472 P(Weight>130|Female):0.431687131199

P(Height>55|Male):0.664475279926 P(Height>55|Female):0.288618884613

Likelihood: 98.8072987045

Iteration: 2

P(Male):0.693090235018 P(Female):0.306909764982

P(Weight>130|Male):0.826679141456 P(Weight>130|Female):0.4302136153

P(Height>55|Male):0.661515446725 P(Height>55|Female):0.298166151757

Likelihood: 98.7405146683

Iteration: 3

P(Male):0.691836811294 P(Female):0.308163188706

P(Weight>130|Male):0.827834636968 P(Weight>130|Female):0.429232073554

P(Height>55|Male):0.659822614142 P(Height>55|Female):0.303444506157

Likelihood: 98.7041724299

Iteration: 4

P(Male):0.691179452244 P(Female):0.308820547756

P(Weight>130|Male):0.828504664302 P(Weight>130|Female):0.428580937724

P(Height>55|Male):0.658854168812 P(Height>55|Female):0.306370599945

Likelihood: 98.6846331311

Iteration: 5

P(Male):0.690845320446 P(Female):0.309154679554

P(Weight>130|Male):0.828891981164 P(Weight>130|Female):0.428147663327

P(Height>55|Male):0.658297042812 P(Height>55|Female):0.307996529916

Likelihood: 98.6742528911

Iteration: 6

P(Male):0.690683683214 P(Female):0.309316316786

P(Weight>130|Male):0.829115739468 P(Weight>130|Female):0.427857439364

P(Height>55|Male):0.657973354737 P(Height>55|Female):0.308902358873

Likelihood: 98.6688132866

Iteration: 7

P(Male):0.690612127135 P(Female):0.309387872865

P(Weight>130|Male):0.829245150095 P(Weight>130|Female):0.427661374544

P(Height>55|Male):0.657782715869 P(Height>55|Female):0.309408634911

Likelihood: 98.6660127995

Iteration: 8

P(Male):0.690586125108 P(Female):0.309413874892

P(Weight>130|Male):0.829320180124 P(Weight>130|Female):0.427527661392

P(Height>55|Male):0.657668529524 P(Height>55|Female):0.309692765472

Likelihood: 98.6646070702

Iteration: 9

P(Male):0.690581990189 P(Female):0.309418009811

P(Weight>130|Male):0.829363845959 P(Weight>130|Female):0.42743557412

P(Height>55|Male):0.65759878706 P(Height>55|Female):0.309853072045

!!!Convergence!!!

Likelihood: 98.6639287506

**STARTING EM ALGORITHM FOR hw2dataset\_100.txt**

Iteration: 1

P(Male):0.698652443023 P(Female):0.301347556977

P(Weight>130|Male):0.789726785895 P(Weight>130|Female):0.375829997926

P(Height>55|Male):0.717909333458 P(Height>55|Female):0.310043629513

Likelihood: 120.007068915

Iteration: 2

P(Male):0.698088416984 P(Female):0.301911583016

P(Weight>130|Male):0.791734996893 P(Weight>130|Female):0.371959791097

P(Height>55|Male):0.719977738679 P(Height>55|Female):0.306022972749

Likelihood: 120.102268233

Iteration: 3

P(Male):0.69767869304 P(Female):0.30232130696

P(Weight>130|Male):0.79318893157 P(Weight>130|Female):0.369173393733

P(Height>55|Male):0.721473691973 P(Height>55|Female):0.303131719172

Likelihood: 120.171856911

Iteration: 4

P(Male):0.697385379166 P(Female):0.302614620834

P(Weight>130|Male):0.794227375332 P(Weight>130|Female):0.367191249397

P(Height>55|Male):0.722541374678 P(Height>55|Female):0.301076693538

Likelihood: 120.221898495

Iteration: 5

P(Male):0.69717760917 P(Female):0.30282239083

P(Weight>130|Male):0.794961791642 P(Weight>130|Female):0.365793422401

P(Height>55|Male):0.723296091933 P(Height>55|Female):0.29962830574

Likelihood: 120.257459044

Iteration: 6

P(Male):0.697031540225 P(Female):0.302968459775

P(Weight>130|Male):0.795477544142 P(Weight>130|Female):0.364813757427

P(Height>55|Male):0.72382591765 P(Height>55|Female):0.298613610911

Likelihood: 120.282515599

Iteration: 7

P(Male):0.696929394848 P(Female):0.303070605152

P(Weight>130|Male):0.795837935197 P(Weight>130|Female):0.364130164886

P(Height>55|Male):0.724196054055 P(Height>55|Female):0.297905771003

Likelihood: 120.300065202

Iteration: 8

P(Male):0.696858231658 P(Female):0.303141768342

P(Weight>130|Male):0.796088883548 P(Weight>130|Female):0.36365463252

P(Height>55|Male):0.724453745698 P(Height>55|Female):0.297413465481

Likelihood: 120.312305218

Iteration: 9

P(Male):0.696808782635 P(Female):0.303191217365

P(Weight>130|Male):0.796263196831 P(Weight>130|Female):0.363324545204

P(Height>55|Male):0.724632722542 P(Height>55|Female):0.297071780411

Likelihood: 120.320816927

Iteration: 10

P(Male):0.696774484509 P(Female):0.303225515491

P(Weight>130|Male):0.796384071521 P(Weight>130|Female):0.363095760318

P(Height>55|Male):0.724756821303 P(Height>55|Female):0.296834978733

Likelihood: 120.326723834

Iteration: 11

P(Male):0.69675072515 P(Female):0.30324927485

P(Weight>130|Male):0.79646779076 P(Weight>130|Female):0.362937353384

P(Height>55|Male):0.724842768884 P(Height>55|Female):0.296671031463

Likelihood: 120.330817236

Iteration: 12

P(Male):0.696734280719 P(Female):0.303265719281

P(Weight>130|Male):0.796525728028 P(Weight>130|Female):0.362827754053

P(Height>55|Male):0.724902246018 P(Height>55|Female):0.296557603814

Likelihood: 120.333651102

Iteration: 13

P(Male):0.696722906026 P(Female):0.303277093974

P(Weight>130|Male):0.796565800244 P(Weight>130|Female):0.362751961816

P(Height>55|Male):0.724943382209 P(Height>55|Female):0.29647916651

Likelihood: 120.335611647

Iteration: 14

P(Male):0.696715041396 P(Female):0.303284958604

P(Weight>130|Male):0.796593505201 P(Weight>130|Female):0.362699566619

P(Height>55|Male):0.724971822261 P(Height>55|Female):0.296424943909

Likelihood: 120.336967361

Iteration: 15

P(Male):0.696709605252 P(Female):0.303290394748

P(Weight>130|Male):0.796612654514 P(Weight>130|Female):0.36266335446

P(Height>55|Male):0.724991479417 P(Height>55|Female):0.296387469306

!!!Convergence!!!

Likelihood: 120.33790453

**Changed Parameters (threshold = 0.001)**

**STARTING EM ALGORITHM FOR hw2dataset\_10.txt**

Iteration: 1

P(Male):0.64525597977 P(Female):0.35474402023

P(Weight>130|Male):0.794468668229 P(Weight>130|Female):0.344937008398

P(Height>55|Male):0.663912072267 P(Height>55|Female):0.258233430597

Likelihood: 46.1310897867

Iteration: 2

P(Male):0.642633046242 P(Female):0.357366953758

P(Weight>130|Male):0.794466586119 P(Weight>130|Female):0.348240138928

P(Height>55|Male):0.66200269845 P(Height>55|Female):0.264644473364

Likelihood: 45.9784033099

Iteration: 3

P(Male):0.642473202566 P(Female):0.357526797434

P(Weight>130|Male):0.794438407768 P(Weight>130|Female):0.348490274894

P(Height>55|Male):0.661924676279 P(Height>55|Female):0.264962330246

Likelihood: 45.9693482213

Iteration: 4

P(Male):0.642462706214 P(Female):0.357537293786

P(Weight>130|Male):0.794435375262 P(Weight>130|Female):0.348508815898

P(Height>55|Male):0.661922203779 P(Height>55|Female):0.264978426877

!!!Convergence!!!

Likelihood: 45.9687957213

**STARTING EM ALGORITHM FOR hw2dataset\_30.txt**

Iteration: 1

P(Male):0.699420470091 P(Female):0.300579529909

P(Weight>130|Male):0.775559028741 P(Weight>130|Female):0.374470409109

P(Height>55|Male):0.671576838003 P(Height>55|Female):0.283736594731

Likelihood: 62.1639275197

Iteration: 2

P(Male):0.689146189072 P(Female):0.310853810928

P(Weight>130|Male):0.779864345912 P(Weight>130|Female):0.37818245712

P(Height>55|Male):0.656773873517 P(Height>55|Female):0.329372793206

Likelihood: 61.6552618679

Iteration: 3

P(Male):0.684631544658 P(Female):0.315368455342

P(Weight>130|Male):0.783137621657 P(Weight>130|Female):0.376826782744

P(Height>55|Male):0.652665624871 P(Height>55|Female):0.342978263258

Likelihood: 61.5276568383

Iteration: 4

P(Male):0.682779350367 P(Female):0.317220649633

P(Weight>130|Male):0.784732787102 P(Weight>130|Female):0.375765756576

P(Height>55|Male):0.651465830481 P(Height>55|Female):0.347368885365

Likelihood: 61.4932563669

Iteration: 5

P(Male):0.682039574999 P(Female):0.317960425001

P(Weight>130|Male):0.785424423174 P(Weight>130|Female):0.37523367955

P(Height>55|Male):0.651093050175 P(Height>55|Female):0.348876036298

Likelihood: 61.4834104011

Iteration: 6

P(Male):0.681747924775 P(Female):0.318252075225

P(Weight>130|Male):0.78570954209 P(Weight>130|Female):0.374998812247

P(Height>55|Male):0.65096963744 P(Height>55|Female):0.349417362024

Likelihood: 61.4804041568

Iteration: 7

P(Male):0.681633706478 P(Female):0.318366293522

P(Weight>130|Male):0.785824111808 P(Weight>130|Female):0.374900862488

P(Height>55|Male):0.65092652337 P(Height>55|Female):0.349617856837

!!!Convergence!!!

Likelihood: 61.4794259755

**STARTING EM ALGORITHM FOR hw2dataset\_50.txt**

Iteration: 1

P(Male):0.70647141732 P(Female):0.29352858268

P(Weight>130|Male):0.745818177337 P(Weight>130|Female):0.436416699267

P(Height>55|Male):0.708715301595 P(Height>55|Female):0.236136786997

Likelihood: 80.1804981233

Iteration: 2

P(Male):0.690739152855 P(Female):0.309260847145

P(Weight>130|Male):0.736927296745 P(Weight>130|Female):0.472014044707

P(Height>55|Male):0.699153204741 P(Height>55|Female):0.28153420792

Likelihood: 79.6024576259

Iteration: 3

P(Male):0.680495612883 P(Female):0.319504387117

P(Weight>130|Male):0.736133222182 P(Weight>130|Female):0.482198611412

P(Height>55|Male):0.694946864181 P(Height>55|Female):0.303882236529

Likelihood: 79.3581335131

Iteration: 4

P(Male):0.67410302182 P(Female):0.32589697818

P(Weight>130|Male):0.737405552917 P(Weight>130|Female):0.484547875691

P(Height>55|Male):0.692666808936 P(Height>55|Female):0.316269305586

Likelihood: 79.2429529823

Iteration: 5

P(Male):0.670101711036 P(Female):0.329898288964

P(Weight>130|Male):0.738992445016 P(Weight>130|Female):0.484391412437

P(Height>55|Male):0.691267751422 P(Height>55|Female):0.323676419552

Likelihood: 79.1847408578

Iteration: 6

P(Male):0.667566039128 P(Female):0.332433960872

P(Weight>130|Male):0.740378355035 P(Weight>130|Female):0.483550337791

P(Height>55|Male):0.690343984265 P(Height>55|Female):0.328335289517

Likelihood: 79.1535664515

Iteration: 7

P(Male):0.665936264852 P(Female):0.334063735148

P(Weight>130|Male):0.741457177556 P(Weight>130|Female):0.482652738584

P(Height>55|Male):0.689710126579 P(Height>55|Female):0.331364954733

Likelihood: 79.1359844842

Iteration: 8

P(Male):0.664874561565 P(Female):0.335125438435

P(Weight>130|Male):0.742253960308 P(Weight>130|Female):0.481891868085

P(Height>55|Male):0.689267696355 P(Height>55|Female):0.333377982605

Likelihood: 79.1256069054

Iteration: 9

P(Male):0.664174709581 P(Female):0.335825290419

P(Weight>130|Male):0.742826333784 P(Weight>130|Female):0.481302451307

P(Height>55|Male):0.688957152382 P(Height>55|Female):0.334733823241

Likelihood: 79.1192431479

Iteration: 10

P(Male):0.663708804437 P(Female):0.336291195563

P(Weight>130|Male):0.743231037844 P(Weight>130|Female):0.480866042839

P(Height>55|Male):0.688739165015 P(Height>55|Female):0.335654794739

Likelihood: 79.1152196588

Iteration: 11

P(Male):0.66339615597 P(Female):0.33660384403

P(Weight>130|Male):0.743514482904 P(Weight>130|Female):0.480551107785

P(Height>55|Male):0.688586486033 P(Height>55|Female):0.336283658432

Likelihood: 79.1126154035

Iteration: 12

P(Male):0.663185026038 P(Female):0.336814973962

P(Weight>130|Male):0.743711834644 P(Weight>130|Female):0.480327360965

P(Height>55|Male):0.688479857296 P(Height>55|Female):0.336714447634

Likelihood: 79.1109000596

Iteration: 13

P(Male):0.66304175453 P(Female):0.33695824547

P(Weight>130|Male):0.743848729127 P(Weight>130|Female):0.480169978655

P(Height>55|Male):0.688405599531 P(Height>55|Female):0.337010134001

Likelihood: 79.1097557443

Iteration: 14

P(Male):0.662944169179 P(Female):0.337055830821

P(Weight>130|Male):0.743943456658 P(Weight>130|Female):0.480060003162

P(Height>55|Male):0.688354013294 P(Height>55|Female):0.337213334298

!!!Convergence!!!

Likelihood: 79.1089853549

**STARTING EM ALGORITHM FOR hw2dataset\_70.txt**

Iteration: 1

P(Male):0.715831156987 P(Female):0.284168843013

P(Weight>130|Male):0.826274272143 P(Weight>130|Female):0.399505908457

P(Height>55|Male):0.686364861699 P(Height>55|Female):0.206492190742

Likelihood: 99.8058163438

Iteration: 2

P(Male):0.706459534425 P(Female):0.293540465575

P(Weight>130|Male):0.826114582409 P(Weight>130|Female):0.413515310374

P(Height>55|Male):0.672228960737 P(Height>55|Female):0.255833352391

Likelihood: 99.2503899988

Iteration: 3

P(Male):0.700488167366 P(Female):0.299511832634

P(Weight>130|Male):0.827139821028 P(Weight>130|Female):0.419343508095

P(Height>55|Male):0.664897891778 P(Height>55|Female):0.281280687852

Likelihood: 98.9784896174

Iteration: 4

P(Male):0.696825564735 P(Female):0.303174435265

P(Weight>130|Male):0.828018626026 P(Weight>130|Female):0.422250158384

P(Height>55|Male):0.661072904279 P(Height>55|Female):0.29470657731

Likelihood: 98.8363711022

Iteration: 5

P(Male):0.694584789266 P(Female):0.305415210734

P(Weight>130|Male):0.828605409837 P(Weight>130|Female):0.423892725293

P(Height>55|Male):0.659104809365 P(Height>55|Female):0.301870442738

Likelihood: 98.7599578724

Iteration: 6

P(Male):0.693201065781 P(Female):0.306798934219

P(Weight>130|Male):0.828964914286 P(Weight>130|Female):0.424905771769

P(Height>55|Male):0.658117904659 P(Height>55|Female):0.305711515327

Likelihood: 98.7181921529

Iteration: 7

P(Male):0.692333902565 P(Female):0.307666097435

P(Weight>130|Male):0.829175873372 P(Weight>130|Female):0.42556990441

P(Height>55|Male):0.657643410791 P(Height>55|Female):0.307772522551

Likelihood: 98.6950658309

Iteration: 8

P(Male):0.691780881297 P(Female):0.308219118703

P(Weight>130|Male):0.829296136444 P(Weight>130|Female):0.426024149401

P(Height>55|Male):0.65743159643 P(Height>55|Female):0.308875683084

Likelihood: 98.6820944458

Iteration: 9

P(Male):0.69142156397 P(Female):0.30857843603

P(Weight>130|Male):0.829362956154 P(Weight>130|Female):0.426344009809

P(Height>55|Male):0.657350687553 P(Height>55|Female):0.309462841162

Likelihood: 98.6747136126

Iteration: 10

P(Male):0.6911837031 P(Female):0.3088162969

P(Weight>130|Male):0.829399022907 P(Weight>130|Female):0.426573705216

P(Height>55|Male):0.657332092047 P(Height>55|Female):0.309772416201

Likelihood: 98.6704432936

Iteration: 11

P(Male):0.691023411161 P(Female):0.308976588839

P(Weight>130|Male):0.829417750303 P(Weight>130|Female):0.426740800665

P(Height>55|Male):0.657340803129 P(Height>55|Female):0.309933242146

Likelihood: 98.6679245443

Iteration: 12

P(Male):0.690913610291 P(Female):0.309086389709

P(Weight>130|Male):0.829426911102 P(Weight>130|Female):0.426863371442

P(Height>55|Male):0.657359487387 P(Height>55|Female):0.310014890661

Likelihood: 98.666406236

Iteration: 13

P(Male):0.690837297455 P(Female):0.309162702545

P(Weight>130|Male):0.829430934897 P(Weight>130|Female):0.42695374773

P(Height>55|Male):0.6573799813 P(Height>55|Female):0.31005483368

!!!Convergence!!!

Likelihood: 98.6654690481

**STARTING EM ALGORITHM FOR hw2dataset\_100.txt**

Iteration: 1

P(Male):0.740008498114 P(Female):0.259991501886

P(Weight>130|Male):0.781365424502 P(Weight>130|Female):0.333791470517

P(Height>55|Male):0.751062742193 P(Height>55|Female):0.150801806506

Likelihood: 121.428059399

Iteration: 2

P(Male):0.743702329876 P(Female):0.256297670124

P(Weight>130|Male):0.772341193369 P(Weight>130|Female):0.353526643407

P(Height>55|Male):0.744877295911 P(Height>55|Female):0.160099073625

Likelihood: 120.98748503

Iteration: 3

P(Male):0.745764923355 P(Female):0.254235076645

P(Weight>130|Male):0.767156287501 P(Weight>130|Female):0.365338061435

P(Height>55|Male):0.741426129326 P(Height>55|Female):0.165478344079

Likelihood: 120.740693724

Iteration: 4

P(Male):0.746991222464 P(Female):0.253008777536

P(Weight>130|Male):0.764014283406 P(Weight>130|Female):0.37266705676

P(Height>55|Male):0.739375097802 P(Height>55|Female):0.168742334748

Likelihood: 120.59349256

Iteration: 5

P(Male):0.747747378362 P(Female):0.252252621638

P(Weight>130|Male):0.762052222784 P(Weight>130|Female):0.377310045859

P(Height>55|Male):0.738110701333 P(Height>55|Female):0.17077982325

Likelihood: 120.502492977

Iteration: 6

P(Male):0.748224121648 P(Female):0.251775878352

P(Weight>130|Male):0.760804810149 P(Weight>130|Female):0.380288571755

P(Height>55|Male):0.737313640376 P(Height>55|Female):0.172074264359

Likelihood: 120.445012143

Iteration: 7

P(Male):0.748528921243 P(Female):0.251471078757

P(Weight>130|Male):0.760002898296 P(Weight>130|Female):0.382214332048

P(Height>55|Male):0.736804098721 P(Height>55|Female):0.172905858724

Likelihood: 120.408214676

Iteration: 8

P(Male):0.748725531038 P(Female):0.251274468962

P(Weight>130|Male):0.759483755716 P(Weight>130|Female):0.383465626591

P(Height>55|Male):0.736475441284 P(Height>55|Female):0.173443940835

Likelihood: 120.384457575

Iteration: 9

P(Male):0.748853081589 P(Female):0.251146918411

P(Weight>130|Male):0.759146161775 P(Weight>130|Female):0.384281272449

P(Height>55|Male):0.736262233498 P(Height>55|Female):0.173793721474

Likelihood: 120.369035991

Iteration: 10

P(Male):0.748936137595 P(Female):0.251063862405

P(Weight>130|Male):0.758925990813 P(Weight>130|Female):0.384814042113

P(Height>55|Male):0.736123404475 P(Height>55|Female):0.174021781714

Likelihood: 120.358990071

Iteration: 11

P(Male):0.748990351225 P(Female):0.251009648775

P(Weight>130|Male):0.758782130321 P(Weight>130|Female):0.385162507416

P(Height>55|Male):0.736032787368 P(Height>55|Female):0.174170771083

Likelihood: 120.35243102

Iteration: 12

P(Male):0.749025794206 P(Female):0.250974205794

P(Weight>130|Male):0.758688016239 P(Weight>130|Female):0.385390625207

P(Height>55|Male):0.735973545735 P(Height>55|Female):0.174268229091

Likelihood: 120.348142199

Iteration: 13

P(Male):0.749048989467 P(Female):0.250951010533

P(Weight>130|Male):0.75862639723 P(Weight>130|Female):0.385540044515

P(Height>55|Male):0.735934776002 P(Height>55|Female):0.174332032493

Likelihood: 120.345335108

Iteration: 14

P(Male):0.749064179578 P(Female):0.250935820422

P(Weight>130|Male):0.75858603253 P(Weight>130|Female):0.385637952129

P(Height>55|Male):0.735909386605 P(Height>55|Female):0.174373825967

Likelihood: 120.343496663

Iteration: 15

P(Male):0.749074131668 P(Female):0.250925868332

P(Weight>130|Male):0.758559581825 P(Weight>130|Female):0.385702122181

P(Height>55|Male):0.735892752312 P(Height>55|Female):0.174401212007

Likelihood: 120.342292111

Iteration: 16

P(Male):0.749080653854 P(Female):0.250919346146

P(Weight>130|Male):0.758542244981 P(Weight>130|Female):0.385744186887

P(Height>55|Male):0.735881850911 P(Height>55|Female):0.174419161505

!!!Convergence!!!

Likelihood: 120.341502673