Teachers' Comparative Judgement Analysis

```
## Rows: 1,155
## Columns: 6
## $ Judge                <int> 123456, 123456, 123456, 123456, 123456, 123456, 1~
## $ Candidate.Chosen     <int> 107, 101, 405, 105, 103, 101, 104, 405, 105, 405,~
## $ Candidate.Not.Chosen <int> 406, 301, 401, 102, 301, 402, 103, 406, 403, 403,~
## $ Time.Taken           <dbl> 4.1, 4.7, 12.1, 15.2, 17.2, 17.4, 21.1, 21.9, 26.~
## $ Internal             <lgl> TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, TRUE, T~
## $ Date.Created         <chr> "17/02/2019 17:38", "17/02/2019 17:38", "17/02/20~
```

Here it is worth noting that there were actually 80 judges who made 15 comparisons, however, 3 of these judges had asterixes in their data row in R

#Number of judges =

```
## [1] 77
```

List of number of judgements per judge =

```
##  [1] 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15
## [26] 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15
## [51] 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15 15
## [76] 15 15
```

Number of scripts =

```
## [1] 16
```

List of number of judgements per script =

```
##  [1] 141 143 143 143 143 144 144 144 144 145 145 145 146 146 147 147
```

Fit to Bradley Terry model.

###SSR=

```
## [1] 0.75
```

###Summary of parameter estimates

Codes:

individual = filename ('script')

Ntot = number of judgements

theta = the parameter estimate

```
## Rows: 16
## Columns: 5
## $ individual <dbl> 101, 102, 103, 104, 105, 106, 107, 301, 302, 401, 402, 403,~
## $ Ntot       <dbl> 143, 144, 143, 143, 143, 145, 147, 145, 144, 146, 144, 147,~
## $ theta      <dbl> -0.562470746, 0.208899753, 0.412826267, 0.263668397, 0.0456~
## $ se.theta   <dbl> 0.1757843, 0.1700118, 0.1719683, 0.1706471, 0.1696389, 0.17~
## $ infit      <dbl> 0.9633977, 0.9934383, 1.0298792, 0.9933816, 1.0458170, 0.97~
```

###Judge misfits

Number of misfits=

```
## [1] 0
```

Misfit threshold (3 SDs above mean) =

```
## [1] 0.622349
```

Table of misfits (shows '0 rows' if na)

```
## [1] Judge   total   average
## <0 rows> (or 0-length row.names)
```

###Script misfits

Number of misfits=

```
## [1] 0
```

Misfit threshold (3 SDs above mean) =

```
## [1] 1.076107
```

Table of misfits (shows '0 rows' if na)

```
## [1] candidate wms
## <0 rows> (or 0-length row.names)
```

###Inter-rater reliability

Number of iterations =

```
## [1] 1000
```

Median Pearson =

```
## [1] 0.559
```

Mean Pearson =

```
## [1] 0.549
```

List of actual correlations =

```
##    [1] 0.017 0.141 0.164 0.177 0.181 0.196 0.199 0.201 0.205 0.205 0.209 0.216
##   [13] 0.221 0.233 0.240 0.243 0.247 0.248 0.249 0.251 0.254 0.260 0.260 0.263
##   [25] 0.270 0.273 0.274 0.275 0.278 0.279 0.279 0.280 0.283 0.285 0.287 0.288
##   [37] 0.289 0.295 0.296 0.298 0.299 0.302 0.303 0.305 0.305 0.306 0.306 0.309
##   [49] 0.309 0.311 0.311 0.316 0.324 0.324 0.328 0.329 0.330 0.331 0.332 0.332
##   [61] 0.333 0.334 0.334 0.335 0.337 0.337 0.340 0.340 0.342 0.342 0.342 0.342
##   [73] 0.343 0.343 0.344 0.344 0.346 0.347 0.349 0.350 0.351 0.352 0.352 0.352
##   [85] 0.355 0.356 0.356 0.359 0.360 0.360 0.360 0.361 0.361 0.361 0.362 0.362
##   [97] 0.363 0.365 0.366 0.369 0.370 0.370 0.372 0.372 0.372 0.373 0.373 0.375
##  [109] 0.375 0.376 0.379 0.380 0.380 0.382 0.382 0.382 0.384 0.384 0.386 0.386
##  [121] 0.388 0.389 0.389 0.389 0.390 0.390 0.391 0.391 0.391 0.392 0.392 0.396
##  [133] 0.396 0.396 0.396 0.396 0.397 0.397 0.398 0.399 0.399 0.399 0.400 0.400
##  [145] 0.401 0.402 0.402 0.404 0.405 0.405 0.406 0.408 0.408 0.408 0.409 0.409
##  [157] 0.409 0.409 0.409 0.409 0.410 0.410 0.412 0.412 0.413 0.414 0.414 0.414
##  [169] 0.414 0.414 0.414 0.414 0.415 0.416 0.417 0.418 0.418 0.418 0.418 0.420
##  [181] 0.420 0.420 0.421 0.421 0.421 0.421 0.422 0.423 0.424 0.424 0.424 0.425
##  [193] 0.426 0.427 0.429 0.429 0.430 0.431 0.432 0.432 0.433 0.434 0.434 0.434
##  [205] 0.434 0.435 0.438 0.438 0.439 0.439 0.439 0.441 0.442 0.443 0.443 0.443
##  [217] 0.443 0.444 0.445 0.445 0.446 0.448 0.448 0.448 0.449 0.449 0.450 0.450
```

```
##  [229] 0.451 0.451 0.452 0.452 0.453 0.454 0.454 0.455 0.455 0.455 0.455 0.456
##  [241] 0.458 0.458 0.459 0.459 0.460 0.460 0.461 0.461 0.461 0.462 0.463 0.463
##  [253] 0.463 0.465 0.466 0.466 0.467 0.467 0.468 0.469 0.470 0.471 0.471 0.471
##  [265] 0.471 0.471 0.472 0.473 0.473 0.474 0.474 0.474 0.474 0.476 0.476 0.477
##  [277] 0.477 0.478 0.478 0.478 0.479 0.480 0.480 0.480 0.480 0.481 0.481 0.482
##  [289] 0.482 0.483 0.484 0.485 0.485 0.485 0.486 0.487 0.487 0.487 0.487 0.488
##  [301] 0.488 0.488 0.489 0.490 0.490 0.490 0.490 0.490 0.491 0.491 0.492 0.493
##  [313] 0.493 0.493 0.493 0.493 0.494 0.494 0.494 0.495 0.496 0.497 0.497 0.497
##  [325] 0.498 0.498 0.498 0.499 0.499 0.499 0.500 0.500 0.501 0.501 0.501 0.501
##  [337] 0.502 0.502 0.502 0.503 0.503 0.503 0.504 0.504 0.504 0.505 0.506 0.506
##  [349] 0.508 0.508 0.508 0.509 0.509 0.510 0.510 0.512 0.512 0.512 0.512 0.512
##  [361] 0.512 0.512 0.513 0.514 0.514 0.514 0.514 0.514 0.514 0.515 0.516 0.517
##  [373] 0.518 0.518 0.518 0.518 0.518 0.518 0.519 0.519 0.519 0.520 0.520 0.520
##  [385] 0.521 0.522 0.523 0.523 0.523 0.524 0.525 0.525 0.525 0.525 0.526 0.526
##  [397] 0.527 0.527 0.527 0.527 0.528 0.528 0.529 0.529 0.529 0.529 0.530 0.530
##  [409] 0.530 0.530 0.530 0.530 0.530 0.531 0.531 0.531 0.532 0.532 0.532 0.532
##  [421] 0.532 0.533 0.533 0.533 0.533 0.533 0.534 0.534 0.534 0.535 0.535 0.535
##  [433] 0.536 0.536 0.536 0.536 0.536 0.536 0.536 0.537 0.537 0.539 0.539 0.539
##  [445] 0.539 0.540 0.541 0.541 0.541 0.541 0.542 0.542 0.542 0.542 0.543 0.544
##  [457] 0.544 0.544 0.545 0.545 0.545 0.546 0.546 0.546 0.547 0.547 0.547 0.548
##  [469] 0.548 0.549 0.549 0.550 0.550 0.550 0.550 0.551 0.551 0.551 0.552 0.552
##  [481] 0.552 0.552 0.553 0.553 0.554 0.554 0.555 0.555 0.556 0.556 0.556 0.556
##  [493] 0.556 0.557 0.557 0.557 0.557 0.558 0.558 0.559 0.559 0.559 0.560 0.560
##  [505] 0.560 0.560 0.561 0.561 0.561 0.561 0.562 0.562 0.562 0.563 0.564 0.565
##  [517] 0.565 0.566 0.566 0.566 0.566 0.567 0.567 0.568 0.568 0.568 0.569 0.570
##  [529] 0.570 0.570 0.570 0.570 0.571 0.571 0.572 0.572 0.572 0.573 0.573 0.573
##  [541] 0.573 0.574 0.574 0.574 0.574 0.574 0.575 0.575 0.575 0.575 0.575 0.575
##  [553] 0.576 0.576 0.576 0.577 0.578 0.578 0.578 0.578 0.579 0.579 0.579 0.579
##  [565] 0.579 0.580 0.580 0.580 0.582 0.582 0.582 0.583 0.583 0.583 0.583 0.583
##  [577] 0.583 0.584 0.584 0.584 0.584 0.584 0.584 0.585 0.586 0.586 0.586 0.587
##  [589] 0.587 0.588 0.589 0.589 0.589 0.589 0.589 0.589 0.590 0.590 0.590 0.590
##  [601] 0.591 0.591 0.591 0.592 0.593 0.593 0.593 0.593 0.593 0.594 0.594 0.595
##  [613] 0.595 0.596 0.596 0.596 0.597 0.597 0.597 0.598 0.598 0.598 0.598 0.598
##  [625] 0.599 0.600 0.600 0.600 0.600 0.601 0.601 0.601 0.601 0.602 0.602 0.602
##  [637] 0.604 0.605 0.605 0.605 0.606 0.607 0.607 0.607 0.608 0.608 0.608 0.608
##  [649] 0.609 0.609 0.609 0.610 0.610 0.610 0.611 0.611 0.612 0.612 0.612 0.612
##  [661] 0.613 0.613 0.613 0.614 0.615 0.615 0.615 0.616 0.616 0.616 0.617 0.617
##  [673] 0.618 0.618 0.618 0.618 0.618 0.619 0.619 0.619 0.620 0.620 0.620 0.621
##  [685] 0.622 0.622 0.622 0.623 0.623 0.623 0.623 0.623 0.623 0.624 0.624 0.624
##  [697] 0.624 0.624 0.626 0.626 0.626 0.627 0.627 0.627 0.628 0.628 0.628 0.628
##  [709] 0.629 0.629 0.629 0.630 0.631 0.632 0.632 0.632 0.632 0.633 0.633 0.633
##  [721] 0.633 0.633 0.634 0.634 0.634 0.634 0.634 0.635 0.636 0.636 0.636 0.636
##  [733] 0.636 0.636 0.636 0.637 0.638 0.639 0.639 0.639 0.639 0.639 0.639 0.640
##  [745] 0.640 0.640 0.641 0.641 0.641 0.641 0.642 0.642 0.642 0.643 0.644 0.644
##  [757] 0.645 0.645 0.646 0.646 0.647 0.648 0.651 0.652 0.652 0.652 0.652 0.652
##  [769] 0.653 0.653 0.653 0.654 0.654 0.655 0.655 0.656 0.656 0.656 0.656 0.657
##  [781] 0.657 0.657 0.658 0.658 0.658 0.659 0.659 0.659 0.659 0.660 0.660 0.660
##  [793] 0.661 0.661 0.661 0.661 0.662 0.664 0.664 0.664 0.665 0.666 0.667 0.667
##  [805] 0.667 0.668 0.668 0.668 0.668 0.668 0.669 0.669 0.670 0.670 0.671 0.672
##  [817] 0.672 0.672 0.672 0.674 0.674 0.674 0.674 0.675 0.675 0.675 0.676 0.676
##  [829] 0.676 0.677 0.677 0.677 0.678 0.678 0.679 0.679 0.679 0.680 0.680 0.680
##  [841] 0.680 0.681 0.681 0.681 0.682 0.683 0.684 0.684 0.684 0.685 0.685 0.685
##  [853] 0.686 0.687 0.687 0.688 0.688 0.689 0.689 0.690 0.690 0.690 0.690 0.690
##  [865] 0.690 0.690 0.691 0.692 0.693 0.693 0.695 0.695 0.695 0.695 0.695 0.696
```

```
##  [877] 0.696 0.696 0.697 0.697 0.697 0.697 0.698 0.699 0.699 0.700 0.701 0.701
##  [889] 0.702 0.702 0.703 0.705 0.705 0.706 0.706 0.707 0.707 0.707 0.709 0.710
##  [901] 0.711 0.711 0.712 0.713 0.714 0.715 0.716 0.716 0.718 0.718 0.720 0.720
##  [913] 0.720 0.721 0.722 0.722 0.723 0.724 0.725 0.726 0.727 0.727 0.730 0.730
##  [925] 0.731 0.732 0.733 0.734 0.734 0.735 0.736 0.736 0.737 0.739 0.740 0.740
##  [937] 0.741 0.741 0.743 0.743 0.747 0.748 0.749 0.750 0.751 0.752 0.754 0.756
##  [949] 0.757 0.758 0.759 0.764 0.766 0.766 0.766 0.766 0.767 0.768 0.771 0.772
##  [961] 0.773 0.773 0.774 0.775 0.775 0.776 0.778 0.780 0.781 0.782 0.783 0.785
##  [973] 0.785 0.787 0.788 0.789 0.789 0.795 0.797 0.799 0.800 0.802 0.804 0.806
##  [985] 0.806 0.810 0.816 0.820 0.820 0.822 0.825 0.827 0.827 0.836 0.840 0.840
##  [997] 0.849 0.854 0.878 0.892
```

Code to randomly choose two groups of 30 to calculate inter-rater reliability (From Prof. Matthew Inglis)

Adjusted Mean Pearson:

```
## [1] 0.4747257
```

The code from NMM marking website:

```
## Loading required package: ggplot2
```

```
## Warning: package 'ggplot2' was built under R version 4.0.5
```

```
## **** Iteration 1 | Maximum parameter change=0.0966451
## **** Iteration 2 | Maximum parameter change=0.0077711
## **** Iteration 3 | Maximum parameter change=0.000471
## **** Iteration 4 | Maximum parameter change=4.79e-05
```

```
## ------------------------------------------------------------
## sirt 3.9-4 (2020-02-17 12:57:09)
## R version 4.0.4 (2021-02-15) x86_64, mingw32 | nodename=DESKTOP-SNFUENT | login=betha
## Date of Analysis: 2022-05-28 14:09:00
## Time difference of 0.03494096 secs
## Computation Time: 0.03494096
##
##
## Call:
## btm(data = df, ignore.ties = TRUE, fix.eta = 0, maxiter = 400,
##     eps = 0.3)
##
## Bradley-Terry Model with Ties and Home Advantage Parameters
## ------------------------------------------------------------
## Number of iterations = 4
## Number of individuals = 16
## Number of pairwise comparisons = 1155
## ------------------------------------------------------------
## Ties and Home advantage parameters
##   parlabel   par est se
## 1     Ties delta -99 NA
## 2     Home   eta   0 NA
## ------------------------------------------------------------
## Summary of individual effects parameters
##   M median     SD     min    max
## 1 0 0.0474 0.3406 -0.6385 0.4538
## ------------------------------------------------------------
## MLE reliability (separation reliability)
## MLE Rel=0.7483
```

```
## Separation index=1.9933
## ------------------------------------------------------------
## Individual effects parameters
##    individual id Ntot N1 ND N0   score propscore   theta se.theta outfit  infit
## 1         101  1  143 52  0 91 52.0818    0.3642 -0.5625   0.1758 0.9583 0.9634
## 2         102  2  144 80  0 64 79.9667    0.5553  0.2089   0.1700 0.9925 0.9934
## 3         103  3  143 85  0 58 84.9434    0.5940  0.4128   0.1720 1.0360 1.0299
## 4         104  4  143 80  0 63 79.9643    0.5592  0.2637   0.1706 0.9931 0.9934
## 5         105  5  143 73  0 70 72.9937    0.5104  0.0457   0.1696 1.0467 1.0458
## 6         106  6  145 83  0 62 82.9566    0.5721  0.3011   0.1702 0.9671 0.9710
## 7         107  7  147 76  0 71 75.9898    0.5169  0.0492   0.1675 0.9740 0.9750
## 8         301  8  145 76  0 69 75.9855    0.5240  0.1478   0.1686 1.0029 1.0020
## 9         302  9  144 73  0 71 72.9958    0.5069 -0.0057   0.1692 1.0170 1.0170
## 10        401 10  146 75  0 71 74.9918    0.5136  0.0273   0.1681 1.0185 1.0181
## 11        402 11  144 58  0 86 58.0583    0.4032 -0.3904   0.1719 1.0109 1.0115
## 12        403 12  147 84  0 63 83.9571    0.5711  0.2794   0.1688 0.9783 0.9801
## 13        404 13  145 63  0 82 63.0393    0.4348 -0.2593   0.1697 0.9567 0.9576
## 14        405 14  141 86  0 55 85.9340    0.6095  0.4538   0.1743 0.9984 0.9972
## 15        406 15  146 62  0 84 62.0452    0.4250 -0.3333   0.1696 1.0082 1.0094
## 16        407 16  144 49  0 95 49.0958    0.3409 -0.6385   0.1775 1.0368 1.0288
## NULL
```

install.packages('knitr')