LNAT

Technical Report
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Scope of Work

This technical report provides statistical information regarding the administration of the LNAT examination. The dates of administration were 1st September 2015 – 30th June 2016. A summary of the statistical analyses for candidates, exam results and items are presented in this report.

Executive Summary

The LNAT examination was completed by 7,849 candidates during the period of 1st September 2015 – 30th June 2016. Item calibration and form equating were carried out in October 2015 with a sample size of 622 candidates who had sat the examination between 1st September 2015 and 4th October 2015. After calibrating the items and equating the forms based on the results of this sample, Scale Score tables were prepared to provide comparable Standard Scores for each candidate.

On completion of the 2015–2016 examination, analysis was carried out on the data from all candidates who had sat the examination during this period. The report that follows gives a detailed analysis of candidate, examination and item data. Arising out of this analysis, the following conclusions are drawn:-

- The results of the equating were satisfactory.

- Reliability of the LNAT examination was moderately good, ranging between 0.64 and 0.76, given the small number of items on each form.

- Some items did not perform as well as expected. These items will be discussed with the item writers to help improve the item writing process.

Background

The LNAT examination is a Critical Thinking test administered to candidates applying to study law at universities that comprise the LNAT consortium. Pearson VUE has been administering the LNAT examination since 2005. The examination is administered from September 1st – June 30th each year via the Pearson VUE CBT platform. The 2015–2016 examination was a 2-part examination with the first section consisting of 5 examination forms consisting of 12 passages of text with 6 passages consisting of 3 multiple-choice items each and 6 passages consisting of 4 multiple-choice items - a total of 42 items per form. The examination length for this section was 80 minutes. The second part of the examination consisted of an essay question for which 40 minutes was allowed. The essay question is not marked and therefore this report pertains solely to the multiple-choice section of the examination.

Demographics

Tables 11–16 in Appendix 1 provide a breakdown of the total cohort of 7,849 candidates into the various demographic groupings. Over 60% of the candidates were female with the majority of candidates aged under 22. In terms of education, over half of candidates (57.4%) were educated in the UK and the largest educational establishment group (18.4%) was for Sixth Form Colleges.

Examination Statistics

The LNAT examination consists of 12 passages of text, 6 passages with 3 multiple-choice items per passage and 6 with 4 multiple-choice passages. This means that the raw score range for the examination is 0–42. To maintain examination security, 5 different examination forms are randomly selected for presentation to candidates. Table 1 below gives descriptive statistics for the raw scores on each of these 5 forms.

Table 1: Raw Score Descriptive Statistics

ExamForm	Mean	SD	Minimum	Maximum	SEM	Alpha	N
FormA1	24.43	5.40	6	38	2.85	0.72	1598
FormB1	22.73	5.10	8	37	2.88	0.68	1579
FormC1	23.97	5.46	5	37	2.77	0.74	1538
FormD1	23.11	5.52	7	38	2.90	0.72	1625
FormE1	22.04	6.04	3	39	2.98	0.76	1509

As can be seen from the above table, the average raw scores on these forms ranged from 22.04–24.43.

Test Score Reliability

Table 1 also displays the Alpha coefficient, indicating the reliability of the test scores, for each form. Reliability indicates how stable or consistent a test score is. Because of the inherent variation in human performance, test scores will always reflect some degree of measurement error. Reliability indices quantify how much measurement error the test scores contain. Coefficient Alpha, the most widely used measure of internal reliability, is given by:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum \sigma_i^2}{\sigma_x^2}\right)$$

:

Where:

k = the number of items in the test

σ_i^2 = the variance of item i

σ_x^2 = the total variance of the test

The valid range of Coefficient Alpha is from -1.0 to +1.0. Larger alpha values indicate a more reliable test. Reliability values over 0.80 are generally regarded as sufficiently reliable.

The LNAT exam reliability coefficients were moderate with a Coefficient Alpha range of 0.68 to 0.76. Reliability coefficients above 0.8 are desirable for these types of examinations. One of the main reasons for the moderate reliability of the LNAT examination is the small number of items; all things being equal, longer examinations will be more reliable.

Scale Scores

Table 1 demonstrates that there is a difference in difficulty between the 5 LNAT forms with candidates finding Form E1 more difficult than Form A1 (an average difference of 2.4 raw score points). To ensure no candidate is disadvantaged by sitting a harder test form than other candidates, it is necessary to equate the scores on the 5 examination forms. For LNAT this takes the form of a 2-step process: first, all of the examination items are calibrated by means of Rasch scaling using the Winsteps software application. Once all items are calibrated onto the same scale, the scores are equated across forms and the individual raw scores are translated to a new scale score.

Table 2: Scale Scores per Form

Form	Mean	SD	Min	Max	N
FormA1	22.45	5.35	5	37	1598
FormB1	23.12	4.71	9	36	1579
FormC1	23.97	5.46	5	37	1538
FormD1	23.57	5.06	9	38	1625
FormE1	21.70	5.29	3	38	1509

Table 2 above shows the descriptive statistics for the new scaled scores. As can be seen the calibration/equating procedures have resulted in each examination form being of approximately equal difficulty, with a difference of 2.27 scale score points between the two extreme forms.

It is important that a test is fair to all candidates and is not biased against a sub-set of the candidate population. Test bias can result from a particular test measuring factors that are irrelevant to the construct being measured. This section provides details on the average score for various demographic breakdowns of the LNAT candidate population. It should be stressed that differences between demographic groups do not necessarily indicate test bias but may be due to factors important to the construct being measured e.g. lack of knowledge.

Table 3: Scale Score by Gender

Gender	Mean	SD	Minimum	Maximum	SE	N
Female	22.45	5.17	3	37	0.07	4973
Male	23.86	5.23	5	38	0.10	2876

The above table shows a small difference in average scores with males slightly outperforming females.

Table 4: Scale Score by Age Group

Candidate Age Group	Mean	SD	Minimum	Maximum	SE	N
16–21	23.11	5.14	5	38	0.06	7131
22–34	22.13	5.85	7	37	0.26	514
35–65	19.43	5.79	3	34	0.44	171
Missing	23.45	5.45	14	32	0.95	33

Table 4 shows small differences between candidate age groups with the 16–21 group scoring slightly higher on average.

Table 5: Scale Score by Education

Education Group	Mean	SD	Minimum	Maximum	SE	N
Educated in the UK	22.95	5.10	5	37	0.08	4507
Educated outside the UK	22.92	5.33	3	38	0.11	2487
Not in Education	23.24	5.84	7	38	0.29	397
Missing	23.25	5.50	8	36	0.26	458

Only small scale score differences are evident between where candidates were educated.

Table 6: Scale Score by Educational Establishment

UK Education	Mean	SD	Minimum	Maximum	SE	N
Academy or City College	22.65	5.00	8	34	0.28	323
College of Further Education	21.01	5.39	6	37	0.26	423
Comprehensive	23.24	4.85	10	35	0.19	686
Grammar	24.73	4.60	9	37	0.18	640
Independent	24.18	4.78	10	37	0.16	862
Sixth Form College	22.07	5.03	5	36	0.13	1446
Other	21.77	5.97	7	37	0.38	243
Missing	23.02	5.40	3	38	0.10	3226

Table 6 shows that candidates from Grammar Schools scored highest on the LNAT, while candidates from Colleges of Further Education scored lowest.

Table 7: Scale Score by Householder Occupation

Occupation Group	Mean	SD	Minimum	Maximum	SE	N
Administrative or Service	21.85	5.36	3	36	0.19	838
Manual or Trade	21.76	5.00	8	35	0.23	487
Professional or Technician	23.41	5.10	10	37	0.17	861
Senior Manager or Official	23.33	5.01	8	37	0.13	1519
Senior Professional	23.92	5.05	6	38	0.13	1432
Not Currently Employed	21.46	5.57	6	35	0.21	732
Missing	23.14	5.24	8	38	0.12	1980

Table 7 shows that the lowest scoring candidates are those who indicate Not Currently Employed for their household, while the highest scoring candidates are from Senior Professional households.

Table 8: Scale Score by Ethnicity

Ethnic Group	Mean	SD	Minimum	Maximum	SE	N
Asian	22.23	5.49	5	38	0.11	2394
Black	20.78	5.08	6	35	0.23	495
Mixed	23.63	4.95	8	35	0.25	380
Other	19.94	5.47	3	37	0.33	275
White	23.85	4.83	5	38	0.08	3648
No Information	23.22	5.29	12	35	0.55	92
Missing	23.28	5.29	8	35	0.22	565

Table 8 shows that candidates from the Other category were the lowest scorers, while white candidates were the highest scorers.

Item Statistics

This section of the report looks at the LNAT examination at the item level.

Table 9: Average Item Difficulty per Form

	Mean	SD	Min	Max	N
Form A	0.59	0.22	0.19	0.96	42
Form B	0.55	0.22	0.12	0.96	42
Form C	0.57	0.24	0.09	0.93	42
Form D	0.55	0.20	0.01	0.87	42
Form E	0.53	0.17	0.11	0.95	42

The above table shows the average item difficulty for each of the forms. Item difficulty values indicate the proportion of candidates who answered an item correctly. Table 9 shows that Form E had the hardest average item difficulty with a mean value of 0.53 (53%), whilst Form A had the easiest average difficulty of 0.59 (59%). With an average difficulty across the 5 forms of 0.56, candidates found this examination fairly difficult and the exam might benefit from a better spread of item difficulties.

Table 10: Item-Total Correlation per Form

	Mean	SD	Min	Max	N
Form A	0.21	0.09	-0.02	0.40	42
Form B	0.18	0.10	-0.07	0.38	42
Form C	0.22	0.09	0.03	0.36	42
Form D	0.20	0.10	-0.10	0.38	42
Form E	0.23	0.10	0.01	0.39	42

Table 10 displays the corrected item-total correlation statistics for each form. The item-total correlation ranges between -1 and +1 with a high positive value indicating that candidates answering an item correctly are also scoring highly on the overall test, while low or negative values indicate there was little relationship between the response to an item and the overall score achieved by the candidate.

Tables 17–21 in Appendix 2 provide item analysis statistics for each of the 5 LNAT forms. For each item the tables show the item difficulty, the proportion of candidates answering the item correctly and the corrected item-total correlation, the correlation between answering the item correctly and the candidates' overall score on the test.

Appendix 1 – Demographic Breakdown of Candidate Totals

Table 11: Gender

	Frequency	Proportion
Female	4973	0.63
Male	2876	0.37

Table 12: Age Group

	Frequency	Proportion
16–21	7131	0.91
22–34	514	0.07
35–65	171	0.02
Missing	33	0.00

Table 13: Education

	Frequency	Proportion
Educated in the UK	4507	0.57
Educated outside the UK	2487	0.32
Not in Education	397	0.05
Information Not Supplied	458	0.06

Table 14: Educational Establishment

	Frequency	Proportion
Academy or City College	323	0.04
College of Further Education	423	0.05
Comprehensive	686	0.09
Grammar	640	0.08
Independent	862	0.11
Sixth Form College	1446	0.18
Other	243	0.03
Missing	3226	0.41

Table 15: Householder Occupation

	Frequency	Proportion
Administrative or Service	838	0.11
Manual or Trade	487	0.06
Professional or Technician	861	0.11
Senior Manager or Official	1519	0.19
Senior Professional	1432	0.18
Not Currently Employed	732	0.09
Missing	1980	0.25

Table 16: Ethnicity

	Frequency	Proportion
Asian	2394	0.31
Black	495	0.06
Mixed	380	0.05
Other	275	0.04
White	3648	0.46
Information Refused	92	0.01
Missing	565	0.07

Table 17: Form A Item Analysis

	N	P-Value	Item-Total Correlation
pas239i1	1550	0.85	0.04
pas239i2	1550	0.53	0.40
pas239i3	1550	0.44	0.19
pas239i4	1550	0.67	0.24
pas268i1	1550	0.35	0.13
pas268i2	1550	0.65	0.23
pas268i3	1550	0.41	0.18
pas275i1	1550	0.82	0.23
pas275i2	1550	0.96	0.20
pas275i3	1550	0.64	0.07
pas275i4	1550	0.78	0.26
pas279i1	1550	0.61	0.21
pas279i2	1550	0.41	0.05
pas279i3	1550	0.43	0.18
pas320i1	1550	0.81	0.29
pas320i2	1550	0.75	0.20
pas320i3	1550	0.78	0.25
pas320i4	1550	0.89	0.21
pass328i1	1550	0.21	-0.02
pass328i2	1550	0.31	0.18
pass328i3	1550	0.69	0.32
pass334i1	1550	0.65	0.16
pass334i2	1550	0.82	0.26
pass334i3	1550	0.20	0.09
pass338i1	1550	0.20	0.18
pass338i2	1550	0.36	0.29
pass338i3	1550	0.69	0.28
pass338i4	1550	0.29	0.16
pass342i1	1550	0.19	0.00
pass342i2	1550	0.35	0.25
pass342i3	1550	0.55	0.04
pass342i4	1550	0.77	0.25
pass353i1	1550	0.83	0.26
pass353i2	1550	0.40	0.21
pass353i3	1550	0.47	0.28
pass353i4	1550	0.88	0.17
pass360i1	1550	0.73	0.26
pass360i2	1550	0.61	0.34
pass360i3	1550	0.78	0.38
pass361i1	1550	0.72	0.25
pass361i2	1550	0.73	0.25
pass361i3	1550	0.41	0.23

Table 18: Form B Item Analysis

	N	P-Value	Item-Total Correlation
pas207i1	1518	0.66	0.27
pas207i2	1518	0.81	0.21
pas207i3	1518	0.61	0.08
pas207i4	1518	0.37	0.11
pas224i1	1518	0.19	0.13
pas224i2	1518	0.24	0.01
pas224i3	1518	0.56	0.11
pas230i1	1518	0.85	0.19
pas230i2	1518	0.88	0.20
pas230i3	1518	0.45	0.16
pas274i1	1518	0.78	0.08
pas274i2	1518	0.82	0.33
pas274i3	1518	0.32	0.20
pas274i4	1518	0.63	0.22
pas275i1	1518	0.81	0.26
pas275i2	1518	0.96	0.21
pas275i3	1518	0.66	0.08
pas275i4	1518	0.83	0.22
pass327i1	1518	0.88	0.18
pass327i2	1518	0.25	0.13
pass327i3	1518	0.29	0.19
pass327i4	1518	0.44	0.11
pass329i1	1518	0.57	0.10
pass329i2	1518	0.29	0.24
pass329i3	1518	0.12	-0.07
pass329i4	1518	0.25	0.29
pass332i1	1518	0.43	0.23
pass332i2	1518	0.78	0.22
pass332i3	1518	0.33	0.36
pass332i4	1518	0.61	0.20
pass339i1	1518	0.68	0.33
pass339i2	1518	0.62	0.21
pass339i3	1518	0.37	0.07
pass344i1	1518	0.70	0.16
pass344i2	1518	0.49	0.25
pass344i3	1518	0.33	0.04
pass352i1	1518	0.59	0.27
pass352i2	1518	0.40	0.23
pass352i3	1518	0.61	0.31
pass356i1	1518	0.51	0.12
pass356i2	1518	0.74	0.38
pass356i3	1518	0.30	0.07

Table 19: Form C Item Analysis

	N	P-Value	Item-Total Correlation
pas199i1	1491	0.87	0.31
pas199i2	1491	0.56	0.26
pas199i3	1491	0.83	0.30
pas205i1	1491	0.66	0.22
pas205i2	1491	0.49	0.15
pas205i3	1491	0.69	0.17
pas205i4	1491	0.71	0.34
pas274i1	1491	0.81	0.17
pas274i2	1491	0.82	0.33
pas274i3	1491	0.32	0.23
pas274i4	1491	0.67	0.20
pas285i1	1491	0.87	0.18
pas285i2	1491	0.66	0.34
pas285i3	1491	0.55	0.03
pass325i1	1491	0.41	0.07
pass325i2	1491	0.65	0.13
pass325i3	1491	0.50	0.28
pass331i1	1491	0.34	0.18
pass331i2	1491	0.17	0.12
pass331i3	1491	0.20	0.13
pass331i4	1491	0.20	0.17
pass335i1	1491	0.77	0.27
pass335i2	1491	0.93	0.28
pass335i3	1491	0.40	0.23
pass335i4	1491	0.41	0.16
pass340i1	1491	0.31	0.18
pass340i2	1491	0.59	0.27
pass340i3	1491	0.74	0.31
pass340i4	1491	0.20	0.09
pass345i1	1491	0.42	0.05
pass345i2	1491	0.57	0.31
pass345i3	1491	0.79	0.25
pass354i1	1491	0.70	0.36
pass354i2	1491	0.63	0.36
pass354i3	1491	0.15	0.13
pass358i1	1491	0.09	0.04
pass358i2	1491	0.72	0.29
pass358i3	1491	0.81	0.32
pass364i1	1491	0.61	0.35
pass364i2	1491	0.54	0.30
pass364i3	1491	0.92	0.16
pass364i4	1491	0.88	0.19

Table 20: Form D Item Analysis

	N	P-Value	Item-Total Correlation
pas165i1	1579	0.57	0.16
pas165i2	1579	0.42	-0.05
pas165i3	1579	0.83	0.19
pas165i4	1579	0.55	0.20
pas229i1	1579	0.71	0.28
pas229i2	1579	0.80	0.23
pas229i3	1579	0.70	0.33
pas276i1	1579	0.53	0.38
pas276i2	1579	0.84	0.27
pas276i3	1579	0.50	0.22
pas276i4	1579	0.34	0.14
pas285i1	1579	0.87	0.18
pas285i2	1579	0.63	0.30
pas285i3	1579	0.54	-0.02
pass343i1	1579	0.49	0.21
pass343i2	1579	0.33	0.12
pass343i3	1579	0.35	0.17
pass347i1	1579	0.67	0.36
pass347i2	1579	0.01	-0.10
pass347i3	1579	0.63	0.08
pass347i4	1579	0.57	0.21
pass349i1	1579	0.81	0.14
pass349i2	1579	0.31	0.24
pass349i3	1579	0.63	0.16
pass349i4	1579	0.80	0.21
pass351i1	1579	0.64	0.23
pass351i2	1579	0.25	0.20
pass351i3	1579	0.31	0.23
pass355i1	1579	0.71	0.19
pass355i2	1579	0.24	0.07
pass355i3	1579	0.30	0.14
pass355i4	1579	0.74	0.24
pass359i1	1579	0.58	0.31
pass359i2	1579	0.67	0.29
pass359i3	1579	0.42	0.18
pass359i4	1579	0.68	0.31
pass362i1	1579	0.57	0.23
pass362i2	1579	0.49	0.26
pass362i3	1579	0.30	0.16
pass75i1	1579	0.72	0.27
pass75i2	1579	0.67	0.33
pass75i3	1579	0.54	0.25

Table 21: Form E Item Analysis

	N	P-Value	Item-Total Correlation
pas125i1	1441	0.41	0.13
pas125i2	1441	0.70	0.27
pas125i3	1441	0.41	0.16
pas269i1	1441	0.44	0.36
pas269i2	1441	0.56	0.29
pas269i3	1441	0.28	0.12
pas276i1	1441	0.53	0.36
pas276i2	1441	0.83	0.33
pas276i3	1441	0.49	0.27
pas276i4	1441	0.34	0.13
pas279i1	1441	0.58	0.21
pas279i2	1441	0.42	0.01
pas279i3	1441	0.44	0.19
pass323i1	1441	0.28	0.10
pass323i2	1441	0.59	0.39
pass323i3	1441	0.70	0.12
pass333i1	1441	0.64	0.31
pass333i2	1441	0.11	0.17
pass333i3	1441	0.50	0.17
pass333i4	1441	0.95	0.25
pass337i1	1441	0.64	0.19
pass337i2	1441	0.53	0.33
pass337i3	1441	0.52	0.07
pass337i4	1441	0.68	0.25
pass346i1	1441	0.54	0.32
pass346i2	1441	0.49	0.26
pass346i3	1441	0.64	0.35
pass348i1	1441	0.59	0.17
pass348i2	1441	0.61	0.27
pass348i3	1441	0.50	0.05
pass348i4	1441	0.73	0.16
pass350i1	1441	0.29	0.18
pass350i2	1441	0.38	0.34
pass350i3	1441	0.31	0.19
pass350i4	1441	0.86	0.18
pass360i1	1441	0.73	0.30
pass360i2	1441	0.57	0.34
pass360i3	1441	0.76	0.38
pass365i1	1441	0.34	0.28
pass365i2	1441	0.51	0.27
pass365i3	1441	0.40	0.13
pass365i4	1441	0.45	0.30