



## PRIMARY EXAM RESULTS - 2013

### *Results of the 2013 Examinations in Radiography, Nuclear Medicine Technology, and Radiation Therapy\**

#### INTRODUCTION

This report summarizes the results of the 2013 examinations in Radiography, Nuclear Medicine Technology, and Radiation Therapy. The Radiography examinations administered in 2013 were assembled according to the content specifications that went into effect in 2012; the Nuclear Medicine Technology and Radiation Therapy exams were based on content specifications that were new in 2011.

Each exam consists of 200 scored test questions. The major content categories and number of questions in each category are listed below.

#### Radiography

<u>Section</u>	<u># Questions</u>
A Radiation Protection	45
B Equipment Operation and Quality Control	22
C Image Acquisition and Evaluation	45
D Imaging Procedures	58
E Patient Care and Education	30

#### Nuclear Medicine Technology

<u>Section</u>	<u># Questions</u>
A Radiation Protection	20
B Radionuclides and Radiopharmaceuticals	22
C Instrumentation and Quality Control	40
D Diagnostic and Therapeutic Procedures	100
E Patient Care and Education	18

#### Radiation Therapy

<u>Section</u>	<u># Questions</u>
A Radiation Protection and Quality Assurance	35
B Clinical Concepts in Radiation Oncology	55
C Treatment Planning	55
D Treatment Delivery	25
E Patient Care and Education	30

**\*Results for the primary exams in Sonography and MRI are contained in separate reports.**

#### INTERPRETATION OF SCORES

**Total Scaled Score.** The ARRT uses scaled scores to report exam results. A total scaled score can range from 1 to 99, and a total scaled score of 75 is required to pass an examination.

Scaled scores are desirable because they take into account the difficulty of a particular exam compared to earlier versions of the same exam. Raw scores (that is, number correct or percent correct) have limited use because they cannot be compared from one version of an exam to the next, or from one year to the next. This lack of comparability exists because one version of an exam might be slightly easier or slightly more difficult than a previous version. A person's raw score on an exam might be a function of exam difficulty rather than his or her level of performance.

Scaled scores take into account any differences in difficulty between two or more versions of an exam. A scaled score of 75 represents the same level of exam performance, regardless of which version of an exam an examinee takes. The use of scaled scores also permits comparison of exam results over time.

Scaled scores are sometimes mistaken for percent correct scores. This confusion probably arises because both scaled scores and percentages have a similar range of values. A scaled score of 75 does not mean that someone correctly answered 75% of the test questions.

**Section Scores.** Performance on each section of the exam is also reported using scaled scores. The primary purpose of the section scores is to provide information to examinees regarding their strengths and weaknesses in particular content categories. Pass/fail decisions are not made for individual sections of the exam. The only score that is important for pass/fail decisions is the total scaled score.

The *Primary Exam Results* report is no longer mailed to educational programs; it is available on the ARRT website. At this location you can also review exam results reports dating back to 2001, along with other statistical reports.

<http://www.arrt.org/examination/statistics>

## EXAMINEE RESULTS

Section scores can range from 1 to 9.9, and are reported in one-tenth point intervals (e.g., 8.1, 8.6). Section scores are intentionally placed on a narrower scale because they are often based on a small number of test questions. Therefore, section scores are not as reliable as the total scaled score, and should be interpreted with some caution.

Scores from the ARRT exams can be evaluated in two general ways. One interpretation involves a comparison of a given score to the scores obtained by other examinees. This is often referred to as a norm-referenced interpretation. A second type involves evaluating a score in terms of the degree to which the examinee has mastered the content covered by the exam. This is usually referred to as a criterion-referenced interpretation, because the focus is on whether a score meets or exceeds some criterion. Although both types of interpretations are valuable, the criterion-referenced interpretation is more relevant for the ARRT exams.

**Passing Score.** A scaled score of 75 is required to pass all ARRT exams. This pass-fail point, called the “cut score”, is established by ARRT’s Board of Trustees through a process called standard setting. During the standard setting process, the Board receives input from a panel representing a broad constituency of radiologic technologists. The cut score represents the standard of performance required to obtain certification. Those who exceed the standard pass the exam.

The scaled score required to pass remains constant at 75. Using scaled scores ensures that those taking different forms are not penalized for taking a slightly more difficult exam. The use of scaled scores adjusts for differences in exam difficulty such that a given scaled score corresponds to the same level of competence regardless of exam form.

Educators and examinees occasionally ask how many questions need to be answered correctly to achieve a scaled score of 75. The answer depends on the difficulty of the particular form that was taken. For Radiography forms used in 2013, a scaled score of 75 corresponded to about 69% correct. This passing score was a product of a 2012 standard setting study that reset the Radiography passing standard, beginning in 2013. For more details on this study refer to the attached article: [ARRT - Radiography Cut Score to Increase in 2013](#). For Nuclear Medicine Technology a scaled score of 75 corresponded to about 61% correct, and in Radiation Therapy a scaled score of 75 corresponded to about 67% correct.

Readers interested in a more detailed explanation of ARRT’s scaling procedures are encouraged to review the brochure, [Settle the Score](#), available at the ARRT website.

**Number of Examinees.** A total of 13,124 first-time examinations were administered for these three primary exams in 2013. Radiography accounted for 89.0% of the total, Nuclear Medicine Technology for 3.9%, and Radiation Therapy for 7.1%. Table 1 on page 5 presents a detailed breakdown for each exam.

The numbers of examinees for all three exams for the past ten years are shown in the charts on page 3. It can be seen that although volumes have been up and down over the 10 years displayed, in 2013 the first-time volumes were at about the same level as in 2004.

**Examinee Performance Statistics.** The results for regular, first-time examinees are shown in Table 2 on page 5. Data are presented for the total year. The mean and standard deviation are reported in scaled score units.

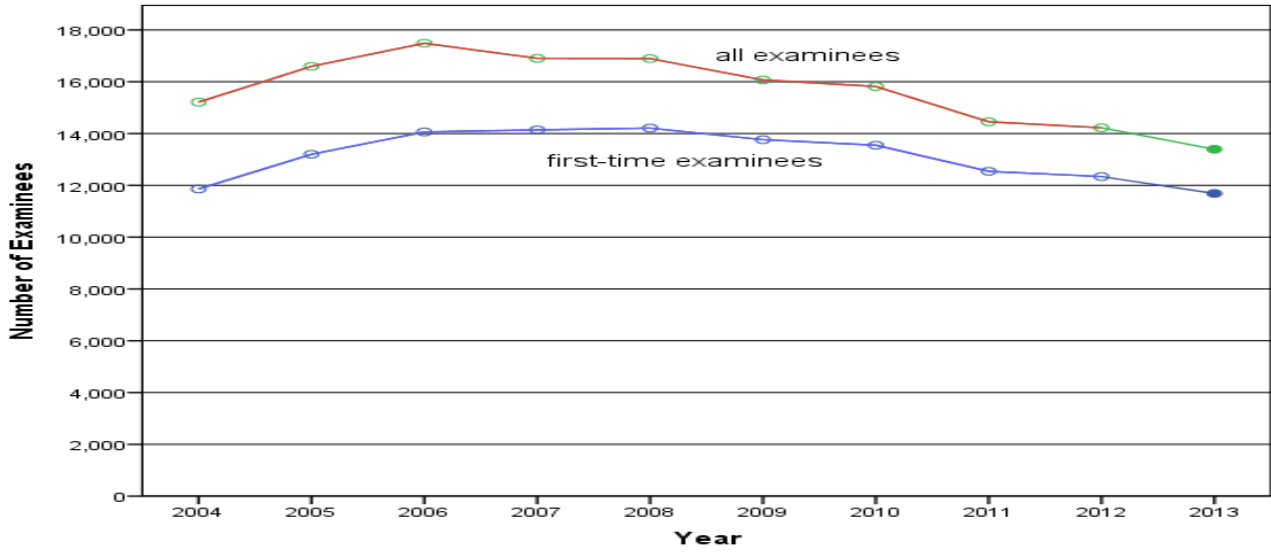
Table 2 presents the national averages for the total exam and for each of the content areas for all three exams. The content area data provides a frame of reference for evaluating the section scores obtained by individual examinees. If, for example, an examinee received a score of 7.8 on section A of the Radiography exam, that examinee’s performance would be below average by 0.8 scaled score units. Note that 0.8 is also the standard deviation for Section A. In other words, this hypothetical examinee scored one standard deviation (0.8) below the mean on Section A.

The mean % correct columns also illustrate how well examinees performed on each specific section of the exam. Each number indicates the average percent correct for the nation as a whole on that section. If a section has 30 questions and the average percent correct is 83%, then it can be determined that on average, examinees correctly answered about 25 questions on that section ( $0.83 \times 30 = 24.9$ ).

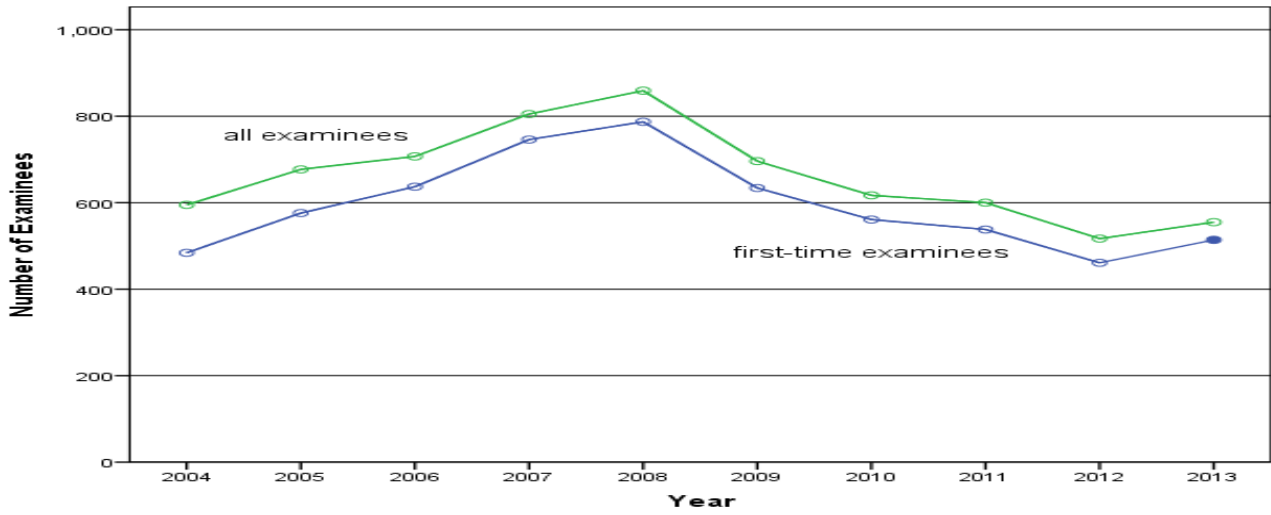
Table 3 on page 6 presents percentile ranks for total scaled scores. A percentile rank indicates the percentage of examinees that scored below a certain scaled score. To obtain an examinee’s percentile rank, simply locate his or her scaled score in the appropriate column (RAD, NMT, or THR) and read off the corresponding percentile rank from the left-most column. For example, an examinee in Radiation Therapy with a scaled score of 88 would be at the 80<sup>th</sup> percentile. In other words, that individual scored higher than 80% of all 2013 first-time examinees in Radiation Therapy. Table 3 does not provide percentile ranks for all scores; therefore, interpolation may be required for certain values.

**Number of Examinees by Year**

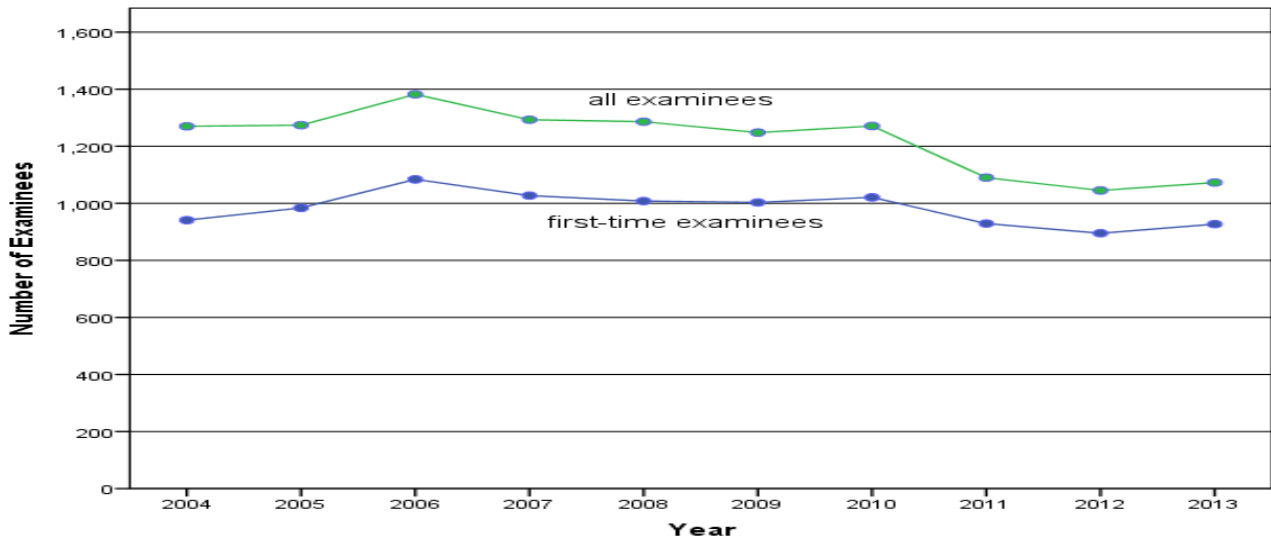
**Radiography**



**Nuclear Medicine Technology**



**Radiation Therapy**



## PROGRAM AND STATE RESULTS

**Mean Scores for Programs.** Educators are often interested in comparing the performance of their educational program to that of all programs in the country. The histograms (bar graphs) on page 7 present the distributions of school means for first-time examinees from schools with two or more first-time examinees in 2013. School means ranged from 64 to 94 for Radiography, from 75 to 93 for Nuclear Medicine Technology, and from 72 to 92 for Radiation Therapy.

The histograms show the number of schools with mean scores at a particular level. A histogram allows a program director to compare the mean of his or her school with that of all other schools. To accomplish this, review the Annual Program Summary Report, available at the ARRT website [www.arrt.org](http://www.arrt.org) under Educators/Program Director Site. The summary report indicates the mean score for first-time examinees who graduated from a given educational program.

As an example, consider the histogram for Radiography. If your school mean was 90, you can compare and see that there were 32 total schools that had means of 90 during 2013. It can also be seen that relatively few schools had means above 90.

One interesting feature of these histograms is that there is a substantial gap between the lowest and highest school means. Much of this variability can be attributed to the small number of graduates from some educational programs. School means for programs with just a few students are very unstable. The extreme example is a program with one examinee. The mean for that program could be very low if the examinee has difficulty, or very high if the examinee happens to be very proficient. For this reason, school means are not included for programs with only one examinee. However, most of the highest and lowest means still correspond to programs with just a few examinees. Because of this, school means should be carefully interpreted.

**State Means.** The mean scaled scores (for first-time examinees) for each state in the United States appear on the maps at the end of this report. Mean scores are not reported when fewer than three examinees from a state took the examination. This step was taken to help ensure the confidentiality of individual examinees.

## CONCLUDING COMMENTS

Data in this report can be used as one source of information for evaluating educational programs. When interpreting school means or state means, it is important to acknowledge that such results are sensitive to several factors. While the quality of the educational program is one of those factors, there are numerous others: the number of examinees on which the means are computed; the characteristics of those examinees; the emphasis of the curriculum; etc.

For more detailed information regarding psychometric properties of ARRT exams, please refer to the Technical Appendix which contains information about exam durations, conversion of raw scores to scaled scores, descriptive statistics for raw section scores, test score reliability (including section and overall test scores), and decision consistency indices. The Technical Appendix is available on the ARRT website at <http://www.arrt.org/examination/statistics>.

**Table 1: Number of Examinees, 2013**

<b>Discipline</b>	<b>First Time</b>	<b>Repeat</b>	<b>State</b>	<b>Re-Rex</b>	<b>Total</b>
<b>RAD</b>	11,684	1,356	31	321	13,392
<b>NMT</b>	513	33	0	9	555
<b>THR</b>	927	119	4	23	1,073
<b>Totals</b>	13,124	1,508	35	353	15,020

Note: The “**State**” category includes non-ARRT examinees who take an exam only for state licensure. The “**Re-Rex**” category includes Re-Rex first-timers and Re-Rex repeaters. Re-Rex is reinstatement by re-examination after non-compliance with the CE requirements.

**Table 2: Performance of Regular, First-Time Examinees, 2013**

<b>Section</b>	<b><u>RAD</u></b>			<b><u>NMT</u></b>			<b><u>THR</u></b>		
	<b>Mean</b>	<b>Std Dev</b>	<b>Mean% Correct</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Mean% Correct</b>	<b>Mean</b>	<b>Std Dev</b>	<b>Mean% Correct</b>
<b>A</b>	8.6	0.8	83	8.4	0.8	75	8.1	0.8	76
<b>B</b>	8.2	1.1	78	8.1	0.9	70	8.2	0.7	77
<b>C</b>	8.1	1.0	76	8.3	0.8	74	8.2	0.8	76
<b>D</b>	8.5	0.8	82	8.5	0.7	78	8.5	0.8	81
<b>E</b>	8.6	0.8	84	8.5	0.8	78	8.5	0.7	80
<b>Total</b>	84.1	7.5	80.7	84.1	6.5	76.0	82.7	6.2	77.7
<b>% Passing</b>	89.6			94.0			90.2		

Note: Section scores are on a scale ranging from 1 to 9.9, and are reported at one-tenth point intervals (e.g., 7.6, 8.3, and so on).

Total scores are on a scale ranging from 1 to 99, and a scaled score of 75 is required to pass.

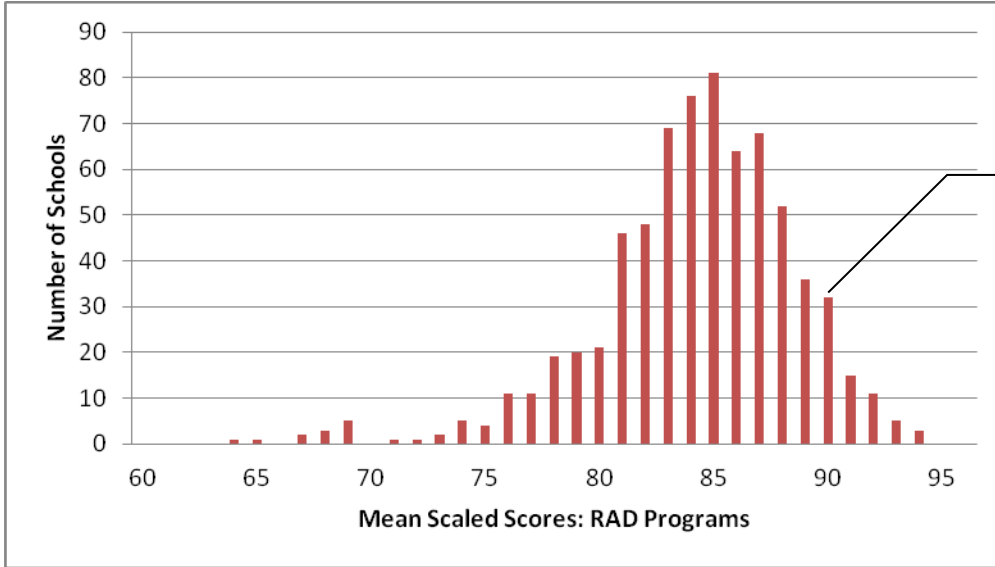
**Table 3: Percentile Ranks for First-Time Examinees, 2013**

Percentile Rank	Scaled Score		
	RAD	NMT	THR
95	94	94	91
90	93	92	90
85	92	91	89
80	91	90	88
75	90	89	87
70	89	88	87
65	88	87	86
60	87	86	85
55	86	85	84
50	85	84	84
45	84	83	83
40	83	83	82
35	82	82	81
30	81	81	80
25	80	80	79
20	78	79	78
15	77	78	76
10	74	76	75
05	70	73	72

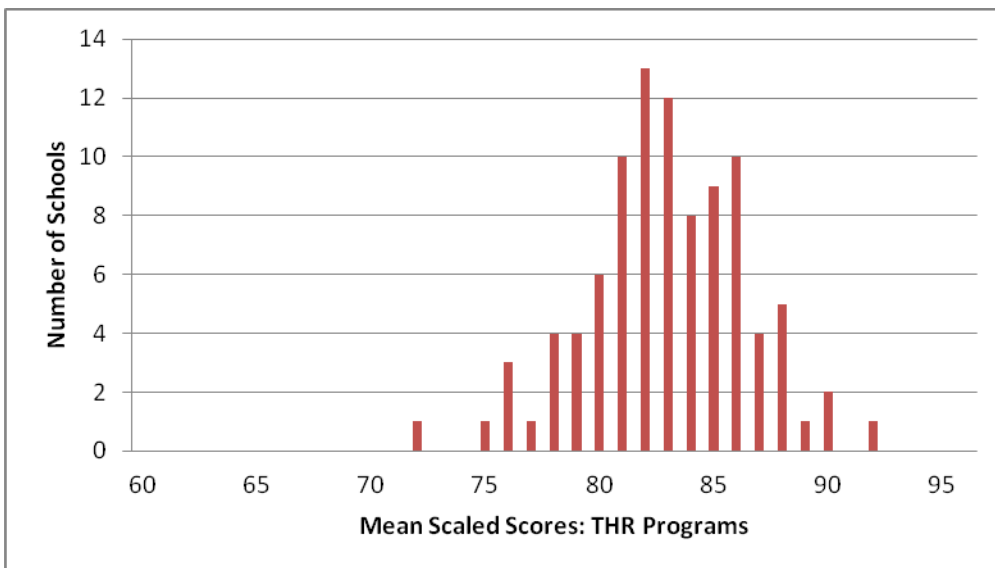
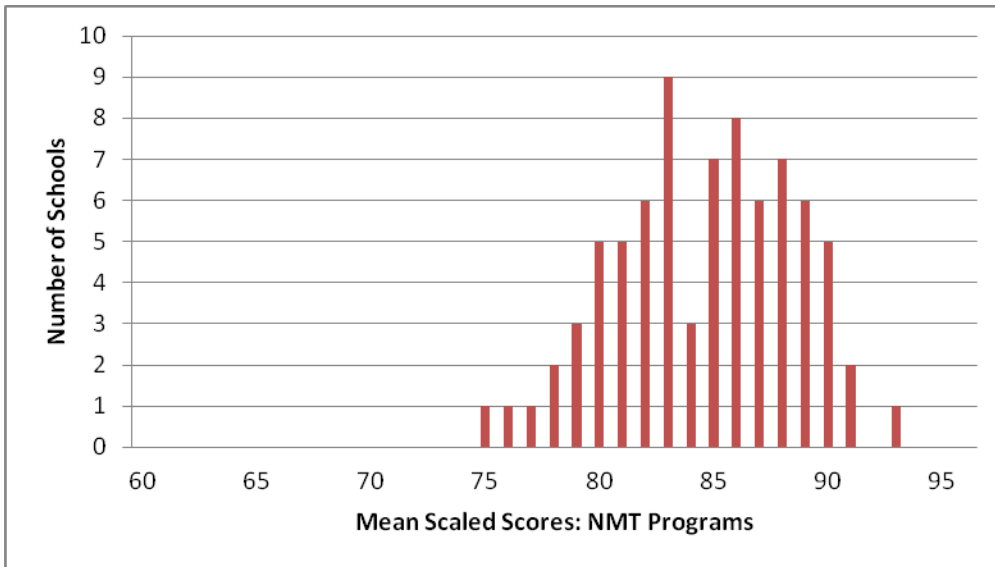
If an examinee received a scaled score of 88, he or she scored higher than 80 percent of all examinees taking the THR exam during the year 2013.

Note: A percentile rank indicates the percentage of examinees scoring below a specified scaled score.

### Distribution of School Means, 2013



If your school mean was 90, you can compare and see that there were 32 total schools that had means of 90 during 2013. Relatively few schools had means above 90.



# 2013 ARRT Radiography State Mean and Number of Examinees\*



\*The mean (average) score is based on regular, first-time examinees. Results are not reported when fewer than 3 examinees from a state took the examination.



# 2013 ARRT Nuclear Medicine Technology State Mean and Number of Examinees\*



\*The mean (average) score is based on regular, first-time examinees. Results are not reported when fewer than 3 examinees from a state took the examination.

# 2013 ARRT Radiation Therapy State Mean and Number of Examinees\*



\*The mean (average) score is based on regular, first-time examinees. Results are not reported when fewer than 3 examinees from a state took the examination.