

# **Practical advice on Using the Cognitive Abilities Test as part of an identification system**

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## **Abstract**

The Cognitive Abilities Test (CogAT) is widely used in the identification of academically talented students. The goal of this document is to provide a practical overview of how to make the best use of CogAT as part of an identification system. Major characteristics of CogAT are also summarized. Some of the topics that are covered include: understanding scores and score warnings; developing local norms; making test accommodations; estimating Form 6 scores when retesting with Form 5; out-of-level testing to increase reliability; using an excel spreadsheet to combine ability and achievement test scores to identify the most academically talented students in all ethnic groups; and additional resources.

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## Three Procedures for Identifying Academically talented Students

In this first section, I describe three procedures for using CogAT as one component of a system for identifying academically talented students from all ethnic and linguistic backgrounds. I put this information first so that those who are familiar with CogAT need not search the document for the major recommendations. However, I have also included brief summaries of much other information on the test that both novices and experienced users should find helpful. I encourage you to consult the papers on my website (<http://faculty.education.uiowa.edu/dlohman/>) and the test manuals (including the free Short Guide for Teachers available at [www.cogat.com](http://www.cogat.com)) for more information.

The first identification procedure shows how to determine a child's standing on any test score (or combination of scores) in three norm groups: the nation, the local population, and opportunity-to-learn subgroups within that population. The procedure requires that all students in a particular grade in the local population (i.e., school) take the screening test. It also requires that one know the basics of using a spread sheet application (such as Microsoft Excel).

The second procedure is simpler. It shows how to combine information from a nationally (or locally) normed ability test with teacher ratings of only those students who are nominated for the TAG program. It can be used to help make decisions about which students are most likely to profit from some form of acceleration and which might best be served by enrichment or additional instruction at grade level.

The third procedure combines elements of the first two procedures. It shows how best to combine scores on ability and achievement tests. Then these composite scores are compared with teacher ratings to inform decisions about acceleration or enrichment for those who are identified as academically talented.

These procedures were developed using the CogAT – Form 6 (Lohman & Hagan, 2001a), the Iowa Tests of Basic Skills (ITBS; Hoover, Dunbar, & Frisbie, 2001) and the Scales for Rating the Behavioral Characteristics of Superior Students (SRBCSS; Renzulli, White, Callahan, Hartman & Westberg, 2002). However, the basic principles can be applied to other ability and achievement tests, and other rating scales. Decisions about educational programming – especially whole grade acceleration – would require additional information, such as some measure of the student's interests, social skills, anxiety, and other characteristics that would be expected to influence the probability of successful learning in the different educational placement options under consideration (Assouline, Colangelo, Lupkowski-Shoplik, Lipscomb, & Forstadt, 2003). These measures are not discussed here. Rather, I focus on a principled way to identify those children who are the best candidates for enrichment or acceleration.

### Procedure 1. Multiple Norm Groups

Detailed directions for using this method are provided in *Identifying academically talented minority students* (NRC Research Monograph RM05216; Lohman, 2005) and in the sample data set that accompanies that monograph (see <http://faculty.education.uiowa.edu/dlohman/>). Here are the steps for using only one test score. Examples in the sample data set that is available on the website show how to combine scores on two variables (such as mathematics achievement and quantitative reasoning abilities). This is important because identification procedures that average ability and achievement scores for particular domains better identify not only those who

currently excel, but also those who are most likely to continue to excel (see Lohman & Korb, 2006).

*Step 1 – Preparing the data.* Get the required data into a spreadsheet. For each student, this would include the student's name or ID, an opportunity to learn index (such as ELL status), national percentile ranks (PRs) or other norm-referenced test scores. On CogAT, these would be Standard Age Scores (SAS) for each of the test batteries and the Quant-Nonverbal Composite (if it was requested from the publisher). If achievement test scores will also be analyzed (as described in Procedure 2), then be sure to input Scaled Scores for Reading Total and Math Total as well. For CogAT and ITBS, these scores can be output to an excel spreadsheet from Riverside's Interactive Results Manager (IRM).

*Step 2 – Getting local ranks.* Sort the data by percentile ranks (or SAS scores). This will provide local ranks.<sup>1</sup> Those with highest scores will be at the top of the list. Local score distributions generally provide a better way to determine which students are most likely to be mismatched with the instruction they are receiving than will national norms. Local norms also make it much easier to identify a relatively consistent number of students across years.

*Step 3 – Looking within groups defined by opportunity to learn.* Sort the data again by opportunity to learn (as the first sorting variable in Excel) and then PR or SAS (as the second sorting variable in Excel). For example, if two opportunity-to-learn groups are used (e.g., ELL versus native speakers), then the most talented ELL students will be those with the highest ranks within the first group and the most talented native-speaking students will be those with the highest ranks in the second group. What kind of enrichment or acceleration to suggest for each depends on the students' levels of achievement and on other factors (such as interest, motivation, and the availability of different educational programs).

## **Procedure 2. Using Ability Test Scores and Teacher Ratings**

This example uses all three CogAT batteries and the three main scales from the Scales for Rating the Behavioral Characteristics of Superior Students (SRBCSS ; Renzulli et al., 2002). The three scales from the SRBCSS are: Learning Ability, Motivation, and Creativity.

Although the procedure can be used when test scores are available for all students in the local population, it is particularly helpful when only some students are rated by their teachers or are administered an ability test. Whenever only a portion of the population is tested, it is important to test a much broader segment of that population than just those students who score highly on an achievement test or who are nominated by their teachers. Testing only those who meet the desired criterion on an achievement test (e.g., 97<sup>th</sup> PR) will eliminate the majority students who score higher on the ability test than on the achievement test. Testing more children is much easier to do when using a group-administered test rather than an individually-administered test. A reasonable rule

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<sup>1</sup> Note that ranks are not the same as the percentile ranks provided in norm tables. However, for most purposes, a simple rank order of the scores is all that is needed. Other scores (e.g. Standard Age Scores) provide additional information on the size of the score gaps between students with different ranks.

is to test every child who scores above average on one or more of the major batteries of the achievement test (typically Reading Total and Math Total for elementary students). If this is done, it is often more administratively convenient to administer the ability test to all children. Classroom teachers are most likely to go along with this procedure if the ability test does more than identify the most able students but also provides information that they can use to help all students learn.<sup>2</sup>

How best to combine scores from the three *CogAT* batteries when predicting academic success is well documented in the research literature. Importantly, the weights that should be applied to each test battery in making these predictions are the same for all ethnic groups that have been studied (Lohman, 2005). Competence in a broad range of verbal domains (e.g., reading comprehension and literary skills) is best predicted by the *CogAT* Verbal SAS score. On the other hand, success in mathematics and domains of study that demand quantitative thinking is best predicted by a combination of the *CogAT* Quantitative and Nonverbal Reasoning Batteries. Further, differences between ethnic groups are often about the same on the Quantitative and Nonverbal batteries (especially on the Multilevel Battery), and so any advantage that might accrue from reduced mean score differences on the Nonverbal Battery are not compromised by combining those scores with scores on the Quantitative Battery. However, adding quantitative reasoning to the mix substantially improves the ability of the test to identify the best students. Therefore, we recommend using the Verbal Battery SAS score and the Quantitative-Nonverbal (QN) *Composite* SAS score to guide admissions decisions.<sup>3</sup> Students should be considered for admission if they obtain either a high Verbal SAS or a high QN Composite SAS.

Research with the *SRBCSS* shows that each of its three main scales provides unique information. Therefore, the decision rule we suggest is that teacher ratings be considered high if any one of the three ratings is high.<sup>4</sup>

How to combine different kinds of information is a critical issue when identifying gifted children. Arraying this information in a matrix makes the information simultaneously available, but does not offer a principled way to combine it. Some programs prefer to follow traditional identification practices in which children are identified primarily (or solely) on the basis of ability and/or achievement test scores that are unusually high, using either national or local norm groups. Others have argued that programs should also serve children whose test scores are somewhat lower (e.g., the top 20% in the local

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<sup>2</sup> As far as we know, *CogAT* (Form 6) is the only ability test that provides this sort of information. Score reports contain a profile index that summarizes the level and pattern of scores across the three batteries for every student. This profile is linked to specific suggestions on how to adapt instruction to improve the likelihood that the student will learn. A free interpretive guide that provides more general advice on adapting instruction to individual differences is also available on the web at [www.cogat.com](http://www.cogat.com).

<sup>3</sup> This composite score can be obtained from the publisher when requesting score reports or computed by averaging the USS scores for the Quantitative Battery and the Nonverbal Battery and then looking up the corresponding SAS and PR scores. Note that simply averaging SAS or PR scores on the separate batteries will not give the proper composite score.

<sup>4</sup> Because ratings are strongly correlated, accepting all students with an “above average” rating on any one of the three rating scales will identify considerably more than half of the students. This is undesirable only if schools cannot find ways to provide enrichment or other instruction for these students. Further, if possible, ratings on every student should be obtained from more than one teacher and then averaged.

group) but whom teachers believe exhibit unusual creativity, commitment to learn, or accomplishments in particular domains (Renzulli, 2005). The identification system we propose balances these perspectives.

|   |                      | <b>Teacher Rating on Learning Ability,<br/>Motivation, or Creativity</b> |                                  |
|---|----------------------|--|----------------------------------|
|   |                      | Below average<br>teacher ratings   | Above average<br>teacher ratings |
| <b><i>CogAT</i><br/>Verbal<br/>or<br/>Quantitative-<br/>Nonverbal<br/>Reasoning</b> | >97 <sup>th</sup> PR | II   | I                                |
|   | >80 <sup>th</sup> PR | IV   | III                              |

The identification scheme is shown in the figure above. The vertical dimension distinguishes children who exhibit superior reasoning abilities from those who exhibit above average reasoning abilities. We have set the cut scores as scoring at or above the 97<sup>th</sup> national percentile rank or at or above the 80<sup>th</sup> national percentile rank on either verbal reasoning or quantitative-nonverbal reasoning. These criteria are commonly used in gifted programs. However, other cut scores could be used in order to identify a particular percentage of the applicant pool. This is a relatively easy way to bring local norms into the picture. For example, one could set the criteria as the 97<sup>th</sup> and 80<sup>th</sup> local percentile ranks to identify students whose abilities are well above those of their classmates. In some schools, these students would have much higher national percentile ranks whereas in other schools they would have much lower national percentile ranks. Similarly, the horizontal dimension distinguishes between children who, when compared to other children nominated for the program, obtain above average teacher ratings and students who obtain average or below average teacher ratings. Note that, for ratings, the average is computed only on the subset of the student population who are nominated for inclusion in the program. Combining these two criteria gives four categories of assessment results.

Children in Category I exhibit superior reasoning abilities on *CogAT* and are rated as highly capable, motivated, or creative by their teachers. Children in Category II also exhibit superior reasoning abilities but, when compared to other children who were nominated, are not rated as highly by their teachers on any one of the three major scales of the SRBCSS. Programs that follow a traditional identification scheme (e.g., self-contained classrooms or schools) would accept children in Category I. Most would also accept children in Category II, given the difficulty of defending rejections on the basis of low teacher ratings. However, the progress of children in Category II should be monitored more closely. Children in Category III exhibit somewhat lower but strong reasoning abilities (80<sup>th</sup> to 96<sup>th</sup> PR) on *CogAT*, and are rated as highly capable, motivated, or creative by their teachers. These children would be included in school-wide enrichment programs that aim to serve a broader range of children. Schools that serve mainly poor and low-achieving students would find that many of their best students

would fall in this category, especially when using national rather than local test norms. Combining test scores and ratings in this way would enable these schools to identify the students most likely to benefit from curriculum compacting or enrichment programs, including instruction at a higher level than that received by most other students in the school. Finally, children in category IV exhibit good but not exceptional reasoning abilities (between 80<sup>th</sup> and 96<sup>th</sup> PR), and are not rated as unusually capable, motivated, or creative by their teachers. Although good students, these children would not be provided with special programming on the basis of either their *CogAT* scores or teacher ratings. However, if rank within opportunity-to-learn group is high, then some form of special assistance could be provided.

### Procedure 3. Using ability scores, achievement scores, and teacher ratings.

Although either of the procedures we have described can be used to improve the identification process, the preferred procedure is to use achievement in addition to ability test scores. This is because the best prediction of subsequent success in school is given not by *CogAT* scores alone, or achievement test scores alone, but by the combination of *CogAT* scores and current achievement in the domain. Further, the best way to combine these scores is to average them.<sup>5</sup> An easy way to average scores is to get the data for both ability and achievement test scores into the spreadsheet, put them on the same score scale, and then average them.<sup>6</sup> Then either procedure 1 or 2 can be followed using these averaged scores. Directions for doing this are given in the sample data set on the web. The steps for this procedure are summarized in the box below

#### Using Ability, Achievement, and Teacher Ratings

1. Gather both achievement test and ability test scores for all children. If possible, test all children in the grade, not just those children teachers nominate.
2. Average ability and achievement test scores by domain, distinguishing verbal-linguistic and mathematical-symbolic domains.  
     Verbal: average z scores for Reading Total and Verbal Reasoning  
     Math: average z scores for Math Total and Quant-Nonverbal Composite
3. Set the upper (e.g., 97<sup>th</sup> PR) and lower (e.g. 80<sup>th</sup> PR) cut points for the ability-achievement composites (this is easily done in Excel. See Footnote 6)
4. Identify those students who score at or above the 97<sup>th</sup> PR, or between the 80<sup>th</sup> and 97<sup>th</sup> PR on either the Verbal Composite or the Math/Nonverbal Composite

<sup>5</sup> Requiring a high score on both the ability test (e.g., *CogAT* Verbal SAS) AND the achievement test (e.g., ITBS Reading Total) gives less satisfactory results. The “AND” rule misses many of the best students. For an explanation, see Lohman and Korb (2006).

<sup>6</sup> The procedure for doing this are given in the sample data set on the web. Averaging test scores that are not on the same scale gives greater weight to the test with the greater variability. Percentile ranks (PR) should generally not be averaged. The PR of the average scale score is generally not the same as the average of two or more PR scores.

5. Obtain teacher ratings for Academic Ability, Creativity, and Motivation only for those children who are nominated for the program. If possible, gather ratings on each child from more than one teacher and then average the ratings of the two teachers for each of the scales on which all students are rated.
6. Determine for each scale whether the student's rating is above or below the mean (or median)
7. Identify those students who have an above average rating on any one of the three rating scales
8. Identify students who fall in each of the four categories defined by the crossing of the two ability categories (80-96<sup>th</sup> PR and 97- 99<sup>th</sup> PR) and teacher ratings (below average, above average).

## Overview of the Cognitive Abilities Test

Form 6 of the *Cognitive Abilities Test*<sup>™</sup> (*CogAT*<sup>®</sup>) appraises the level and pattern of cognitive development of students from kindergarten through grade 12. The test measures both general and specific reasoning abilities. The general reasoning abilities reflect the overall efficiency of cognitive processes and strategies that enable individuals to learn new tasks and solve problems, especially in the absence of direct instruction. These abilities are assessed in three domains: verbal, quantitative, and nonverbal. Each is represented by two or three different reasoning tasks. Having *multiple measures* in each domain greatly increases the dependability of the score profile that is reported for each student.

The *Cognitive Abilities Test* measures developed abilities, not innate abilities. The development of these abilities begins at birth and continues through early adulthood. It is influenced by both in-school and out-of-school experiences. Because these abilities are closely related to an individual's success in school in virtually all subjects, test results may be used in planning effective instructional programs. In combination with other relevant information about a student, scores can be used to adapt instruction in ways that enhance the student's chances of success in learning.

## Structure of the Test

Each battery of *CogAT* uses a variety of test tasks; for example, the tasks on the Verbal Battery of Levels A–H include verbal classification, sentence completion, and verbal analogies. These tasks are good measures of abstract reasoning skills and are developmentally appropriate for the age and grade levels of the students being tested. Although the same kinds of abstract reasoning skills are tested from kindergarten through grade 12, developmental differences between students in the primary grades and those in grades 3 through 12 require that different types of test tasks be used. In addition, the procedures for administering *CogAT* are different in kindergarten through early grade 3 from those used in grades 3 through 12. To accommodate these developmental differences, *CogAT* has two separate series of tests: a Primary Battery containing Levels K, 1, and 2 and a Multilevel Battery containing Levels A through H.



Levels K through 2 can be used from the beginning of kindergarten through grade 2, although Level 2 can be used in grade 3 for students who are slow in cognitive development. Levels A through H are administered to students from grades 3 through 12. Level A can also be used in grade 2 to appraise students who have a faster rate of cognitive development than their age peers. The overlapping of Level 2 of the Primary Battery and Level A of the Multilevel Battery in grades 2 and 3 and the multilevel format of Levels A through H allow school personnel to adjust the difficulty level of *CogAT* to a student's rate of cognitive development. This permits the most reliable assessment of the student's cognitive skills to be obtained in any school grade. The complete series provides a continuous scale for appraising cognitive growth and development from the beginning of kindergarten through grade 12.

## Using the Test Results

The three primary uses of *CogAT* scores are (1) to guide efforts to adapt instruction to the needs and abilities of students, (2) to provide an alternative measure of cognitive development, and (3) to identify students whose predicted levels of achievement are markedly discrepant from their observed levels of achievement. A brief discussion of each use follows.

The first and most important use of *CogAT* scores is to help teachers adapt instructional goals, methods, and materials to the individual needs of students. Advice on how to do this is provided in the *Short Guide for Teachers* (available at [www.cogat.com](http://www.cogat.com)).

The second use of *CogAT* is to provide a measure of each student's level of cognitive development that captures important information not represented in school grades or in other measures of school achievement. For example, only about half of the students who score in the top 3 percent on the *Iowa Tests of Basic Skills*<sup>®</sup> also score in the top 3 percent on *CogAT*. This means that *CogAT* will identify many students as academically gifted who would not be identified on the basis of academic achievement alone. Conversely, *CogAT* scores show that most low-achieving students are able to reason at higher levels than their academic performance suggests. In fact, the lower the students' scores on an achievement test, the greater the probability that their *CogAT* scores will be at significantly higher levels. See the section "Encouraging Information for Many Low-Achieving Students" in Part 5 of the *CogAT Form 6 Interpretive Guide for Teachers and Counselors* for more information.

The third use of *CogAT* scores is to identify students whose levels of academic achievement are substantially lower or higher than expected given their *CogAT* scores. Students whose achievement is markedly below expectations should be checked for other problems such as learning disabilities, poor vision or hearing, the need for more assistance in completing school lessons, or the need for a different instructional program. On the other hand, students whose academic performance is better than would be expected from their *CogAT* scores should also be examined. These students have learned well the specific skills taught in school but are less successful in solving unfamiliar problems. Such students might profit from tasks that emphasize transfer and innovation. For more information, see the section "Interpreting Discrepancies between Ability and Achievement" in Part 5 of the *Interpretive Guide for Teachers and Counselors* and the section "Using *CogAT* to Identify Students with Unexpectedly High or Low Levels of Achievement" in Part 2 of the *Interpretive Guide for School Administrators*.

## Types of Norms

Two types of norms, age norms and grade norms, are provided for all levels of *CogAT*. Age norms permit educators to compare one student's performance on the test to that of other students in the same age group. Grade norms permit one student's performance to be compared to that of other students in the same grade group.

**Age Norms.** The age norms for *CogAT* extend from 4 years and 11 months to 18 or more years. When the Riverside Scoring Service® scores *CogAT*, students are grouped by age in one-month intervals from 4 years and 11 months through 18+ years. When tests are hand scored using the *CogAT Form 6 Norms Booklet*, three-month intervals are used.

**Grade Norms.** The grade norms provided for *CogAT* cover the range from kindergarten through grade 12 for three test periods in the school year—fall, midyear, and spring. Although the majority of students in a particular grade fall within a narrow age range, some individuals are much younger or older than the typical student. For example, at the beginning of first grade, the majority of students are likely to range in age from 6 years and 2 months to 7 years; however, there are students in some first-grade classes who are 5 years and 9 months old and some who are 8 years old. When a student's age is typical for the group, the student's age and grade scores will be identical or nearly so. However, if individuals are very young for the grade, their age scores will be higher than their grade scores. If individuals are much older than the typical student in the grade, their grade scores will be higher than their age scores. For individuals who are younger or older than the typical student in a grade, grade norms, rather than age norms, are more appropriate to use when trying to understand the student's academic performance.

**Local Norms.** In many school systems, the characteristics of the student population differ markedly from those of a national sample of school-age children. When national norms are used in these districts, the scores of students on both achievement and ability tests are likely to be skewed toward the high or low extremes of the score distribution. Local norms provide another perspective by comparing the performance of each student to others in the local norm group. This perspective can be critical when making decisions about a child's need for special educational programming within the school. Such decisions should be made on the discrepancies between the cognitive and academic development and the development of other children in the child's class (see Lohman, 2005; Renzulli, 2005).

## Types of Scores

The starting point for the construction of all norms is the number of correct answers that students mark on their answer document or test booklet. The number of correct answers given by a student is called the raw score. A raw score can be converted into a Universal Scale Score. The first step in developing norms for *CogAT* was to construct a Universal Scale Score.

**Universal Scale Score (USS).** The *Universal Scale Score* is a normalized standard score that is used as the entry for all of the age and grade norms tables for *CogAT*. The USS provides a continuous growth scale of cognitive development from

kindergarten through grade 12. The *CogAT Form 6 Norms Booklet* provides tables for converting the raw score on each battery to a Universal Scale Score. The USS is then used for entry to tables in the *Norms Booklet* that give the following scores for each battery: (1) a Standard Age Score, (2) percentile ranks by age and by grade, and (3) stanines by age and by grade. Note that it is the USS score – not the number correct – that is the critical score.

Items range from easiest to most difficult. The different levels of CogAT contain samples of items that increase in difficulty. As one moves from level to level, the easiest items are dropped and an equal number of harder items are added. Therefore, the same raw score will correspond with a higher USS score as one moves from lower to higher levels of the test. Moving up one, two, or even three levels can give a more dependable score for children who answer correctly nearly all items on a given level of the test. Missing or correctly guessing the answer to a question will have much less impact on the child's USS score when the level of the test appropriately matches the ability of the child (see discussion of Out-of-Level Testing, below).

**Standard Age Score (SAS).** The *Standard Age Score* scale is a normalized standard score scale for each battery and the Composite. The SAS has a mean of 100 and a standard deviation of 16. It permits educators to compare the rate and level of cognitive development of an individual to other students in the same age group. The SAS scale provides fine discriminations among high- and low-scoring students.

SAS scores are NOT IQ scores. Even though scores on CogAT correlate highly with those obtained from individually administered ability tests, CogAT does not purport to be a measure of "intelligence." It measures reasoning abilities, not the much broader range of abilities that are sampled by good intelligence tests. Furthermore, norms are based on those students who attend school and are able to take a group-administered test. Intelligence tests, on the other hand, go to great lengths to obtain representative samples of the entire population.

**Percentile Rank (PR).** A *percentile rank* indicates the percentage of students in the same age or grade group whose scores fall below the score obtained by a particular student. For example, if a fifth-grade student obtained a grade PR of 90 on the Quantitative Battery, it means that 90 percent of the fifth-grade students in the standardization sample received scores lower than the score obtained by this particular student. Percentile scores expand the score scale near the mean and compress it near the tails of the distribution. For example, all SAS scores above 134 fall in the 99<sup>th</sup> PR. For *CogAT*, percentile ranks are provided for both age and grade groups.

**Stanine (S).** The stanine scale is a normalized standard score scale consisting of nine broad levels designated by the numbers one through nine. Stanines are provided for both age and grade groups. Stanines, which are similar to percentile ranks, are relatively easy to use because they are all one-digit numbers. For example, a stanine of 9 means that the students who scored in the top 4 percent of the sample. The major advantage of stanines is that the broad groupings discourage overinterpretation of small, insignificant differences among test scores.

## Understanding Score Profiles

Since *CogAT*'s inception, the authors have encouraged teachers to focus on the student's scores on the three *CogAT* batteries rather than on the student's Composite score. (In fact, the early editions of *CogAT* did not even report a Composite score.) The scores on the three batteries make up a student's score profile.

A profile must capture two things: (1) it must tell which scores that are significantly higher or lower than other scores and (2) it must report the overall level of performance (i.e., the height of the profile). The scores that are significantly higher or lower are referred to as the *pattern* of the scores, and the overall height of the profile is the *level* of the scores. The same pattern—say a higher score on the Verbal Battery than on the other two batteries—has different implications for instruction if the student's middle age stanine (the level of the profile) is 2 than if the student's middle age stanine is 8.

But how can we know if the verbal score is significantly higher than the quantitative score? All test scores have some error of measurement, so the difference should be larger than the error in either score. For most test-takers, these errors are about the same size and can be directly estimated from the reliability coefficient. However, Form 6 of *CogAT* goes one step further and estimates the error of measurement anew for each student. This means that a low score will *not* be interpreted as a relative deficit just because the student misunderstood one of the subtests or otherwise exhibited confusion in the answers marked.

Using the individual error scores, confidence intervals are drawn around each of the three battery scores. These confidence bands appear on the *List of Student Scores* and on the *Profile Narrative Report*. Based on this information, the score profiles are classified as **A**, **B**, **C**, or **E** profiles.

**“A” Profiles.** In an **A** profile, the student's verbal, quantitative, and nonverbal scores are roughly at the same level. There is only one other piece of information provided by the test, and that is the overall height, or level, of the profile. This is what we would expect if reasoning ability were a single dimension. It is the pattern assumed whenever a student's ability is summarized in a single score. About one-third of students obtain this profile.

**“B” Profiles.** A **B** profile means that one of the scores is **aBove** or **Below** the other two scores. The student shows a relative strength (when one score is above the other two) or a relative weakness (when one score is below the other two). For example, **B (V+)** means that the scores show a **B** profile with a strength in verbal reasoning; **B (N-)** means a relative weakness on the Nonverbal Battery. Overall, approximately 40% of students obtain a **B** profile. Thus, **B** profiles are more common than **A** profiles.

**“C” Profiles.** This profile is called **C** for **C**ontrast. The student shows a relative strength *and* a relative weakness. This pattern is much less common. About 14% of students have a **C** profile. A student who shows a relative strength on the Verbal Battery and a relative weakness on the Quantitative Battery would have a **C (V+ Q-)** profile.

**“E” Profiles.** The **B** or **C** profile for some students is much more extreme than for others. The authors call any profile in which there is a difference of 24 or more points (on the SAS scale) between two scores an **E**, or **Extreme**, profile. Approximately 14% of students show an **E** profile. These profiles are helpful in identifying twice-exceptional students.

**Level of Scores.** Suggestions for teaching depend on both the pattern and the level of the student’s scores. The letters **A**, **B**, **C**, and **E** say something about the *pattern*. An estimate of the *level* is captured in the number that precedes the letter. This number is the student’s middle age stanine. For example, if the student has age stanines of 6, 3, and 8 on the Verbal, Quantitative, and Nonverbal batteries respectively, the student’s middle age stanine would be 6. A score profile of **6B (V+)** means that the student’s middle age stanine was 6. This is the best estimate of the student’s typical level of reasoning ability outside of the verbal domain. It is the baseline against which the verbal strength is measured. Stanines may be grouped as follows:

- Stanine 9 Very high
- Stanines 7–8 Above average
- Stanines 4–6 Average
- Stanines 2–3 Below Average
- Stanine 1 Very low

In general, the profile number (middle age stanine) carries the most information for **A** profiles, less for **B** profiles (now we must also consider the strength or weakness), still less for **C** profiles, and the *least* information for **E** profiles.

### Score Warnings for CogAT Form 6

A sample entry from the List of Student Scores report is shown below. The circled numbers are keyed to the paragraphs in the Interpretive Guide for Teachers and Counselors. You should pay particular attention to several items.

#### Sample entry from a List of Student Scores

| STUDENT NAME   |  | Birth Date | Level (Gender) | No. of Items                      |      | Raw Score | USS | AGE SCORES |    |   | GRADE SCORES |   | Local Norms | PR 1 | Ability Profile     | Profile |         |
|----------------|--|------------|----------------|-----------------------------------|------|-----------|-----|------------|----|---|--------------|---|-------------|------|---------------------|---------|---------|
| I.D. Number    |  | Age        | Form           | No.                               | Att. |           |     | SAS        | PR | S | PR           | S | PR          | S    | Age Percentile Rank |         |         |
| F-1 F-3 Code   |  | Program    |                | A B C D E F G H I J K L M N O P Z |      |           |     |            |    |   |              |   |             |      | 25 50 75 99         |         |         |
| Camona, Amanda |  | 09/99      | C (F)          | 85                                | 85   | 58        | 210 | 112        | 77 | 7 | 81           | 7 | 90          | 8    | V 77                |         | 6B (C-) |
| 0000127780     |  | 11-07      | 8              | 80                                | 50   | 41        | 189 | 97         | 43 | 5 | 44           | 5 | 54          | 5    | Q 43                |         |         |
|                |  |            | GT 01          | 85                                | 85   | 54        | 200 | 108        | 69 | 6 | 72           | 6 | 81          | 7    | N 69                |         |         |
|                |  |            |                | COMPOSITE                         |      |           | 208 | 106        | 66 | 6 | 67           | 6 | 77          | 7    | C 65                |         |         |

First, compare columns 5A (Number of Items in the battery) with 5B (Number of Items the student attempted). Students should not be omitting many items on the Verbal and Nonverbal Batteries. This could signal an unusually slow but accurate response style. If extreme, this will trigger a warning (see “Many items omitted”). Omitting many items is rarely a problem on the Verbal Battery, but can impact scores on the Quantitative Battery. In large measure this seems to reflect an emphasis on reflective thinking in the teaching in the teaching of mathematics in some schools. If this seems to be a problem in your school (i.e., Quantitative scores are lower than expected), then consider telling

students to work quickly (or at least not to work slowly) on these tests. An easier solution is simply to use local norms.

Over 50 years of experience in administering both group and individual ability tests has convinced the test authors that many people misinterpret scores on ability tests. One solution to this problem is to try to re-educate test users about what ability tests do and do not measure (see, e.g., Lohman, 2006). Another solution is to warn users about potential problems that might compromise interpretation of scores. These score warnings are a major feature of CogAT. Look for them in the score reports and, unless the warning can be dismissed (a child was deliberately tested out of level), decisions about the child should not be made using such scores. Note particularly the warning “‡ **Extremely variable responses.**” This is always a red flag. It says that, for this child, scores within that battery were inconsistent. When this happens, the error bands around the child's score for that battery (see the sample entry above) will be unusually wide. Even if there is no score warning but the error bands seem unusually wide, look more closely at the child's test booklet or answer sheet.

### CogAT (Form 6) Score Warnings

- # **Too few items attempted.** Too few items were attempted to permit an estimation of a score on this battery and the complete Composite.
- o **Excluded from group averages by school request.** The student's scores are excluded from class, school, and district averages at the school's request.
- << **Age is out-of-range; age-based scores are not reported.** Either the student's age is outside the valid range to calculate age scores (4 years 11 months to 21 years 7 months) or the date of birth was not indicated.
- ~ **Estimated level.** Either the test level was left blank or it was double-gridded and had to be estimated. In certain circumstances, this may indicate that the level was forced in order to correct for misgridded information.
- § **Level unusual for coded grade.** The test level is unusual for the grade indicated. Double-check the accuracy of the grade and level information for the student. This may also indicate that the student was purposely tested off-level.
- **Targeted score.** The number of correct answers marked is at or below a chance level; that is, the raw score could have been obtained by randomly marking answers to the test items.
- ‡ **Extremely variable responses.** Responses to items or subtests were inconsistent. For example, the student may have missed many easy items but correctly answered many of the more difficult items. Or, the student scored much lower on one of the subtests than on the other subtest(s) within the same battery. The error of measurement for the score on this battery is, therefore, unusually large.

- ^ **Many items omitted.** The student omitted many items, apparently due to a very slow, but accurate, response style.
- a **Age unusual for coded level.** The student's age is unusual for the level of *CogAT* taken. Double-check the accuracy of the age and level information for the student. This may also indicate that the student was purposely tested off-level.

## Tips on Test Administration

In this section I offer some suggestions for administering CogAT that are often overlooked. However, this is not a substitute for the Directions for Administration that accompany the test.

### Read the directions

- I'm astonished by the number of people who are surprised to learn that they should not use the overall composite score from identifying academically talented children. Beginning with the fourth edition of CogAT Every edition of CogAT (published in 1984), the test manual has included a section on recommendations for using CogAT to identify gifted students. All explicitly state: Do not use the overall composite score! Only about one third of the students at all score levels shown an even or "A" score profile. Many academically talented students show significantly (even markedly) uneven score profiles. These students will have lower overall composite scores than students who show an even score profile.
- Practice reading the directions for each test before you attempt to administer it.

### Prepare the students for the test

- For kindergarten children, practice the rules of the game: no calling out answers, no copying, no moving about the room, etc. Encourage children to see the activity as a special game, not a "test." If children are anxious, it is usually because their parents (and sometimes teachers) have made them so. For such children, it is even more important to make taking the test a fun activity. Contrary to horror stories in the news media, research shows that children actually enjoy the activity.
- If at all possible, go over the directions for the test—especially those with unfamiliar item formats such as matrices—a day or two before the test. Make up additional practice items to ensure that ALL children understand what they are supposed to do. NEVER start the test unless you are sure that the children understand what they are supposed to do.
- Never make decisions—either to admit a child to a special class or to deny admission—on the basis of a single test score. Many children who obtain high scores on one test occasion will get much lower scores on another administration of the same test. Neither the highest nor the lowest score provides the best estimation the child's ability. Unless one score is clearly invalid, the best estimate is given by the average score across multiple administrations of parallel tests.

## Provide appropriate Accommodations.

Accommodations are modifications to standard test administration procedures that are designed to remove impediments to performance that are unrelated to the construct being measured by the test but which can influence performance on it. The CogAT manuals provide guidance on this topic. The discussion here is limited to *extra time* and *read-aloud* accommodations. Further, since neither of these accommodations is needed on the Primary Battery, these comments apply only to the Multilevel Battery.

The most common accommodation in group testing is to allow additional time. In general, allowing more time has little effect when the time limits for the test are sufficiently generous that at least 90 percent of the students have time to attempt every item. This is the case on the CogAT Verbal Battery. Our studies show that allowing an extra 2 minutes per battery has little impact on CogAT Verbal scores. However, time can be a factor for all students when the number of items on the test exceeds the number that most students attempt. This is often the case on the Quantitative Battery. Fewer students attempted all of the items on the Quantitative Battery on Form 6 of CogAT 6 than on Form 5, in spite of the fact that test length was the same and items were designed to be parallel. Changes in the way mathematics is taught seem to be the primary cause. This means, however, that allowing some students extra time will not only compensate for a learning disability. Additional time would probably increase their scores even if they did not have the disability. Therefore, if allowing extra time raises the child's scores on the Quantitative and, to a lesser extent, Nonverbal batteries to the level where the child qualifies for special services, it would be wise to seek additional corroborating evidence. (We will soon be issuing a report on the study on this accommodation, so contact me if interested.)

CogAT is not a test of student's reading abilities. Therefore, there is no prohibition against reading (i.e., decoding but not explaining) items to students. If one knows in advance that this will be necessary because of a reading disability, it would be best to test the child individually or with other children who need this accommodation for the Verbal Battery.

## Retesting with Form 5

Test users who administer Form 6 of CogAT® sometimes need to retest students after only a short interval. Administering the same form of a test after a short delay confounds general practice effects with memory for specific items. A better procedure is to administer an alternate form of the test. The three tables in the Appendix can be used to estimate Universal Scale Scores (USS) on CogAT Form 6 for students who have previously taken Form 6 and are then retested with Form 5. The tables cannot be used to estimate Form 6 USS scores for students who have only taken Form 5.

The tables were developed from data collected in a special Equating Study in which 6,628 students were administered both Form 5 and Form 6 of *CogAT*. Order of administration was counterbalanced. The average of the two administration conditions was used to compare the changes in norms for Standard Age Scores between 1992, when Form 5 norms were developed, and 2000, when Form 6 norms were developed (see "Part 6: Equivalence of Forms" in the *CogAT Form 6 Research Handbook*). Tables reported here are based only on those students who took Form 6 first and then Form 5.



Order of administration matters, so the tables should only be used to estimate Form 6 USS scores from a Form 5 retest for students who have previously taken Form 6.<sup>7</sup>

There are three tables, one for each *CogAT* battery. For example, assume the student was first administered Level A of Form 6 and then later retested with Level A of Form 5.<sup>8</sup> The student obtained retest raw scores of 57, 58, and 60 on the Verbal, Quantitative, and Nonverbal batteries, respectively. These correspond to Form 6 USS scores of 199, 211, and 207. USS scores can then be converted to SAS and/or PR scores using the appropriate age and/or grade tables in the *CogAT Form 6 Norms Booklet*.

## Thinking in terms of Developmental Scales

One of the most important – but least appreciated features of *CogAT* is the fact that all levels of each of the each test battery (Verbal, Quantitative, Nonverbal) are mapped on to a single developmental scale. This means that the raw score that a child obtains on any level of the test is converted to this developmental scale score (called a USS score for “Universal Scale Score”).

The USS scores that a child obtains shows how well the child performed on the test in a way that is *independent of the norm group*. In other words, a child who obtains a USS score of 180 on the Verbal Battery performed better on the test than a child who obtained a USS score of 160. These children could be in the same grade or in different grades; the same age or different ages. There are as many different PR's for a given USS score as there are norm groups. For example, children who are the best performers in kindergarten perform better on the test than children who are much older.

For example, consider the child who obtains a Verbal USS score of 188 in the fall of kindergarten. This puts the child at the 98 PR when compared to other kindergarteners. But it also places her at the 96<sup>th</sup> PR when compared to those entering first grade or the 90<sup>th</sup> PR when compared to those entering the second grade. K-1 growth is least on the Verbal Battery (10 USS points) and greatest on the Quantitative and Nonverbal Batteries (about 17-19 USS points). This means that, for Non-ELL children, estimates of their ability (compared to age or grade mates) that based on the Verbal scale are less likely to change than scores for the other scales (i.e., larger average growth means greater variability in growth across ages/grades).

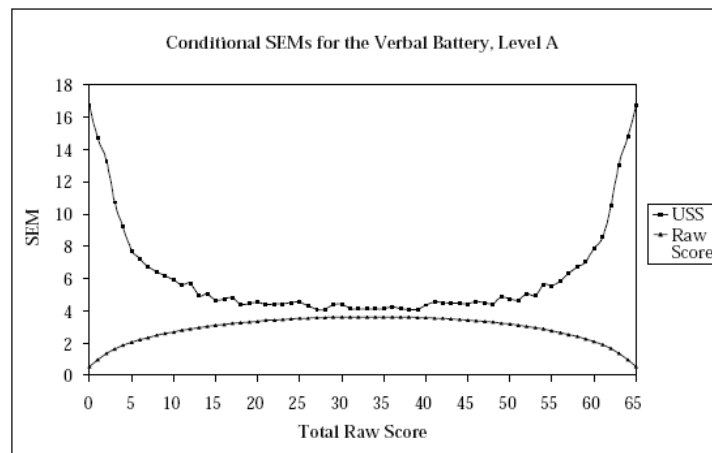
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<sup>7</sup> A fundamental assumption of test equating is that the equating transformations be symmetric. This means that the function that maps Form 5 scores onto the Form 6 scale must be the inverse of the function that maps Form 6 scores onto the Form 5 scale. This is not the case here. The tables apply only to the case in which Form 6 is administered prior to Form 5. Put differently, these are not equating tables but the product of a nonlinear linking function.

<sup>8</sup> Note that there is no requirement that the student be administered the same level of both tests. Indeed, students who score near the ceiling on a particular level of Form 6 should be retested with a higher level of Form 5. This will allow them to obtain a higher USS score. However, moving from the Primary Edition (Levels K-2) on one form to the Multilevel Edition (Levels A-H) on the other form is likely to show somewhat larger score changes than administering another level within the same edition. This is because the Primary Edition is shorter and measures somewhat different abilities than the Multilevel Edition.

## Out of Level Testing

Many Schools administer the same level of CogAT to all students within a class. For this reason, each test level is constructed to be appropriate for the vast majority of students. If items were made sufficiently difficult to challenge the most able students, many less able students would find the test unnecessarily difficult and frustrating. Each level of the test provides excellent measurement for students at the first to the 90<sup>th</sup> percentiles (midyear grade norms). Errors of measurement for Standard Age Scores, however, increase substantially after that point. This is shown in the figure below. The figure shows that errors of measurement in USS scores increase substantially as the raw score on the battery approaches the minimum or maximum possible (0 and 65, respectively). Note that this increase in error of measurement is NOT unique to CogAT. It occurs on every fixed-length test. However, most tests do not report this information. This is unfortunate because it is critical when identifying gifted students.



The table below shows that if Level A is administered to every student, errors of measurement remain reasonably small for all students who score below the 90<sup>th</sup> percentile. Thereafter, errors increase substantially. Testing these high-scoring students with Level B helps some, although errors are still quite large for students at or above the 98<sup>th</sup> percentile. For these students, Level C is more appropriate. Thus, the level of the test that is most appropriate depends on the ability level of the student. Keep in mind, however, that errors on the PR scale will be much smaller than errors on the USS or SAS scales are more finely differentiated at high scores, relative to PR scores.

**Standard Errors of Measurement (SEM) for Selected Verbal Battery  
USS Scores for Levels 2, A, B, and C of CogAT Form 6**

| Fall Grade 3<br>Verbal NPR | Verbal<br>USS | SEM by Test Level |      |      |      |
|----------------------------|---------------|-------------------|------|------|------|
|                            |               | 2                 | A    | B    | C    |
| 98                         | 216*          | 13.4              | 13.9 | 10.4 | 8.4  |
| 90                         | 197           | 11.4              | 7.5  | 5.9  | 5.2  |
| 50                         | 169           | 7.5               | 4.5  | 4.2  | 4.1  |
| 10                         | 140           | 7.4               | 4.6  | 5.3  | 6.6  |
| 2                          | 124*          | 7.7               | 6.0  | 7.5  | 10.5 |

\*Average USS

Therefore, if more accurate and dependable SAS scores are needed, high-scoring students should be tested out of level. The table below identifies the appropriate test level based on midyear grade norms. If, on the other hand, age- or grade-based percentile ranks are the critical score, there is ordinarily much less need for out-of-level testing. For more detailed information, see the CogAT Form 6 *Research Handbook*.

Lowest Test Level Providing the Best Measurement of Standard Age Scores at Various  
Percentile Ranks (Midyear Grade Norms).

| Midyear<br>PR | Grade Level in School |   |   |   |   |   |   |   |   |   |    |    |    |
|---------------|-----------------------|---|---|---|---|---|---|---|---|---|----|----|----|
|               | K                     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| <90           | K                     | 1 | 2 | A | B | C | D | E | F | F | G  | G  | H  |
| 90-95         | 1                     | 2 | A | B | C | D | E | F | G | G | G  | G  | H  |
| 96-98         | 2                     | A | B | C | D | E | F | F | G | G | H  | H  | H  |
| 99            | 2                     | B | C | D | E | F | G | G | H | H | H  | H  | H  |

In general, the recommendation for out-of-level testing (using midyear norms) may be summarized as follows. For students who score below the 90<sup>th</sup> percentile on-level testing is recommended. For more accurate Standard Age Scores for students who score between the 90<sup>th</sup> and 95<sup>th</sup> percentiles, add one level; for students who score between the 95<sup>th</sup> and 98<sup>th</sup> percentiles, add two levels; for students who score at the 99<sup>th</sup> percentile, add three levels. Estimates of these percentile ranks can be derived from a prior administration of CogAT or from the Composite score on a well-constructed achievement test such as the ITBS or ITED.

At levels A through H, it is easy to administer multiple levels of CogAT simultaneously; however, one can reduce the amount of out-of-level testing by following the general recommendation to test one level higher for above-average classes. Because CogAT is designed to be relatively easy for an average-ability class, moving up one level has virtually no effect on the measurement error in the scores of lower-scoring students taking the Multilevel Battery. However, lower-scoring students in the primary grades should be tested on level.

## Where to Get More Information

*CogAT Form 6 Short Guide for Teachers* (free at [www.cogat.com](http://www.cogat.com) )

*CogAT Form 6 Interpretive Guide for Teachers & Counselors*

*CogAT Form 6 Interpretive Guide for School Administrators*

For general background on adapting instruction to individual differences:

Stanford Aptitude Seminar (2002) *Remaking the concept of Aptitude: Extending the legacy of Richard E. Snow*. Mahwah, NJ: Erlbaum.

## References

(see <http://faculty.education.uiowa.edu/dlohman/> for copies of some of these papers)

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VERBAL Battery

Form 5

Form 6 Verbal USS

| <u>Raw score</u> | <u>1</u> | <u>2</u> | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> | <u>G</u> | <u>H</u> |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 0                | 11       | 24       | 65       | 76       | 85       | 95       | 104      | 112      | 120      | 129      |
| 1                | 35       | 43       | 78       | 91       | 85       | 95       | 124      | 134      | 139      | 144      |
| 2                | 57       | 68       | 92       | 105      | 113      | 122      | 132      | 141      | 150      | 156      |
| 3                | 68       | 80       | 101      | 113      | 124      | 135      | 138      | 145      | 157      | 165      |
| 4                | 76       | 88       | 107      | 118      | 130      | 140      | 143      | 150      | 162      | 170      |
| 5                | 82       | 95       | 111      | 123      | 134      | 145      | 146      | 153      | 165      | 174      |
| 6                | 87       | 100      | 116      | 127      | 137      | 148      | 149      | 157      | 169      | 177      |
| 7                | 92       | 105      | 119      | 130      | 140      | 150      | 152      | 160      | 172      | 182      |
| 8                | 96       | 109      | 122      | 132      | 143      | 152      | 154      | 164      | 174      | 185      |
| 9                | 101      | 113      | 126      | 135      | 144      | 154      | 157      | 167      | 176      | 188      |
| 10               | 103      | 116      | 128      | 137      | 146      | 156      | 160      | 171      | 178      | 191      |
| 11               | 106      | 120      | 130      | 139      | 148      | 158      | 162      | 173      | 180      | 193      |
| 12               | 110      | 123      | 132      | 141      | 149      | 160      | 165      | 177      | 182      | 195      |
| 13               | 113      | 126      | 134      | 143      | 151      | 161      | 166      | 179      | 184      | 197      |
| 14               | 116      | 129      | 136      | 145      | 152      | 163      | 169      | 181      | 186      | 198      |
| 15               | 118      | 132      | 137      | 146      | 154      | 165      | 171      | 184      | 188      | 200      |
| 16               | 121      | 134      | 139      | 148      | 155      | 166      | 173      | 185      | 189      | 201      |
| 17               | 125      | 138      | 140      | 149      | 157      | 168      | 175      | 187      | 190      | 202      |
| 18               | 127      | 140      | 142      | 150      | 158      | 169      | 176      | 189      | 192      | 204      |
| 19               | 129      | 142      | 143      | 152      | 159      | 170      | 178      | 190      | 193      | 205      |
| 20               | 132      | 145      | 145      | 153      | 160      | 172      | 180      | 191      | 195      | 206      |
| 21               | 135      | 147      | 146      | 155      | 162      | 173      | 181      | 192      | 197      | 207      |
| 22               | 137      | 150      | 147      | 156      | 163      | 174      | 182      | 193      | 198      | 208      |
| 23               | 140      | 153      | 148      | 157      | 164      | 176      | 184      | 194      | 199      | 209      |
| 24               | 143      | 155      | 149      | 158      | 165      | 177      | 185      | 195      | 200      | 210      |
| 25               | 145      | 157      | 151      | 160      | 166      | 178      | 186      | 196      | 201      | 211      |
| 26               | 149      | 159      | 152      | 161      | 168      | 180      | 187      | 197      | 203      | 212      |
| 27               | 151      | 162      | 153      | 162      | 169      | 181      | 189      | 198      | 204      | 213      |
| 28               | 154      | 164      | 154      | 164      | 170      | 183      | 190      | 199      | 205      | 214      |
| 29               | 158      | 166      | 155      | 165      | 171      | 184      | 191      | 200      | 206      | 214      |
| 30               | 162      | 168      | 156      | 166      | 172      | 185      | 192      | 201      | 207      | 215      |
| 31               | 165      | 170      | 158      | 167      | 173      | 186      | 194      | 201      | 208      | 216      |
| 32               | 171      | 173      | 158      | 168      | 175      | 187      | 194      | 202      | 209      | 217      |
| 33               | 175      | 175      | 159      | 169      | 177      | 189      | 195      | 203      | 210      | 218      |
| 34               | 182      | 178      | 160      | 171      | 178      | 190      | 196      | 204      | 212      | 219      |

## Form 5

Form 6 Verbal USS

| <u>Raw score</u> | <u>1</u> | <u>2</u> | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> | <u>G</u> | <u>H</u> |
|------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 35               | 189      | 180      | 161      | 172      | 179      | 191      | 197      | 204      | 213      | 220      |
| 36               | 201      | 182      | 162      | 173      | 181      | 192      | 198      | 205      | 214      | 221      |
| 37               | 223      | 185      | 164      | 174      | 182      | 193      | 199      | 206      | 215      | 222      |
| 38               | 223      | 189      | 165      | 175      | 183      | 195      | 200      | 207      | 216      | 222      |
| 39               | 223      | 192      | 166      | 176      | 185      | 196      | 201      | 208      | 217      | 223      |
| 40               | 223      | 195      | 168      | 178      | 187      | 197      | 203      | 209      | 218      | 225      |
| 41               |          | 198      | 169      | 179      | 188      | 198      | 203      | 210      | 219      | 226      |
| 42               |          | 202      | 171      | 181      | 189      | 200      | 204      | 211      | 220      | 226      |
| 43               |          | 206      | 172      | 182      | 191      | 201      | 205      | 211      | 221      | 227      |
| 44               |          | 213      | 174      | 184      | 192      | 202      | 206      | 212      | 222      | 228      |
| 45               |          | 219      | 175      | 186      | 194      | 203      | 208      | 214      | 224      | 229      |
| 46               |          | 226      | 176      | 187      | 196      | 205      | 209      | 215      | 225      | 231      |
| 47               |          | 232      | 178      | 189      | 197      | 206      | 210      | 216      | 226      | 232      |
| 48               |          | 239      | 180      | 190      | 199      | 207      | 212      | 217      | 227      | 233      |
| 49               |          |          | 182      | 192      | 201      | 209      | 213      | 218      | 228      | 235      |
| 50               |          |          | 184      | 194      | 202      | 210      | 214      | 219      | 229      | 236      |
| 51               |          |          | 185      | 196      | 204      | 212      | 215      | 220      | 231      | 238      |
| 52               |          |          | 187      | 197      | 206      | 213      | 217      | 222      | 232      | 239      |
| 53               |          |          | 190      | 199      | 207      | 215      | 219      | 224      | 233      | 241      |
| 54               |          |          | 192      | 201      | 209      | 217      | 220      | 225      | 235      | 243      |
| 55               |          |          | 194      | 203      | 211      | 218      | 222      | 227      | 236      | 245      |
| 56               |          |          | 197      | 205      | 213      | 220      | 224      | 229      | 238      | 248      |
| 57               |          |          | 199      | 208      | 215      | 222      | 226      | 231      | 240      | 250      |
| 58               |          |          | 202      | 211      | 218      | 224      | 229      | 234      | 242      | 253      |
| 59               |          |          | 206      | 213      | 221      | 227      | 232      | 236      | 244      | 256      |
| 60               |          |          | 209      | 216      | 224      | 231      | 235      | 238      | 247      | 260      |
| 61               |          |          | 213      | 219      | 227      | 236      | 239      | 243      | 251      | 265      |
| 62               |          |          | 218      | 223      | 231      | 241      | 244      | 247      | 254      | 269      |
| 63               |          |          | 227      | 228      | 238      | 252      | 249      | 252      | 261      | 278      |
| 64               |          |          | 236      | 235      | 247      | 268      | 260      | 260      | 277      | 291      |
| 65               |          |          | 244      | 254      | 261      | 270      | 276      | 275      | 290      | 300      |

| <u>Form 5</u>    |          | <u>QUANTITATIVE Battery</u> |          |          |          |          |          |          |          |          |
|------------------|----------|-----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| <u>Raw score</u> | <u>1</u> | <u>2</u>                    | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> | <u>G</u> | <u>H</u> |
| 0                | 25       | 42                          | 65       | 77       | 84       | 91       | 98       | 104      | 111      | 118      |
| 1                | 50       | 67                          | 84       | 98       | 105      | 115      | 114      | 130      | 132      | 138      |
| 2                | 63       | 77                          | 96       | 109      | 114      | 124      | 129      | 136      | 142      | 146      |
| 3                | 70       | 85                          | 105      | 115      | 121      | 131      | 136      | 140      | 149      | 154      |
| 4                | 77       | 91                          | 111      | 120      | 126      | 135      | 142      | 143      | 154      | 159      |
| 5                | 83       | 97                          | 115      | 124      | 131      | 138      | 146      | 146      | 158      | 163      |
| 6                | 88       | 100                         | 119      | 128      | 135      | 141      | 150      | 148      | 162      | 167      |
| 7                | 92       | 104                         | 122      | 131      | 139      | 144      | 153      | 150      | 165      | 171      |
| 8                | 95       | 108                         | 125      | 133      | 141      | 146      | 156      | 153      | 168      | 175      |
| 9                | 98       | 110                         | 128      | 136      | 145      | 149      | 158      | 156      | 170      | 178      |
| 10               | 101      | 113                         | 130      | 138      | 147      | 151      | 160      | 158      | 172      | 180      |
| 11               | 104      | 116                         | 132      | 140      | 150      | 153      | 163      | 160      | 174      | 183      |
| 12               | 107      | 119                         | 134      | 142      | 152      | 154      | 165      | 162      | 177      | 185      |
| 13               | 110      | 121                         | 136      | 144      | 154      | 156      | 167      | 164      | 179      | 188      |
| 14               | 112      | 123                         | 137      | 146      | 155      | 158      | 168      | 166      | 181      | 190      |
| 15               | 115      | 126                         | 139      | 147      | 157      | 159      | 170      | 169      | 183      | 192      |
| 16               | 117      | 127                         | 140      | 149      | 159      | 161      | 172      | 171      | 185      | 193      |
| 17               | 119      | 129                         | 142      | 150      | 160      | 162      | 173      | 174      | 186      | 195      |
| 18               | 122      | 132                         | 144      | 152      | 162      | 164      | 174      | 176      | 188      | 197      |
| 19               | 124      | 134                         | 145      | 153      | 163      | 165      | 175      | 178      | 190      | 198      |
| 20               | 126      | 135                         | 146      | 154      | 164      | 167      | 177      | 181      | 191      | 199      |
| 21               | 128      | 137                         | 148      | 156      | 165      | 168      | 178      | 183      | 193      | 201      |
| 22               | 130      | 139                         | 149      | 157      | 166      | 170      | 179      | 185      | 194      | 202      |
| 23               | 133      | 140                         | 150      | 158      | 167      | 172      | 181      | 187      | 195      | 203      |
| 24               | 135      | 142                         | 152      | 159      | 168      | 173      | 181      | 189      | 196      | 205      |
| 25               | 137      | 143                         | 153      | 160      | 170      | 174      | 182      | 191      | 198      | 206      |
| 26               | 139      | 145                         | 154      | 162      | 170      | 176      | 183      | 193      | 199      | 207      |
| 27               | 142      | 147                         | 156      | 163      | 171      | 178      | 185      | 194      | 201      | 208      |
| 28               | 145      | 148                         | 156      | 164      | 172      | 179      | 186      | 195      | 202      | 209      |
| 29               | 147      | 150                         | 157      | 165      | 173      | 181      | 187      | 197      | 204      | 210      |
| 30               | 150      | 152                         | 158      | 167      | 175      | 183      | 188      | 198      | 205      | 211      |
| 31               | 153      | 153                         | 159      | 168      | 175      | 184      | 190      | 199      | 206      | 212      |
| 32               | 156      | 155                         | 161      | 169      | 176      | 186      | 191      | 201      | 208      | 213      |
| 33               | 159      | 157                         | 162      | 170      | 177      | 187      | 192      | 202      | 209      | 215      |
| 34               | 163      | 159                         | 163      | 172      | 178      | 189      | 193      | 203      | 210      | 216      |
| 35               | 168      | 161                         | 164      | 173      | 180      | 190      | 194      | 205      | 211      | 217      |
| 36               | 172      | 164                         | 166      | 174      | 180      | 192      | 195      | 206      | 213      | 218      |
| 37               | 179      | 166                         | 167      | 175      | 181      | 193      | 197      | 207      | 214      | 219      |
| 38               | 188      | 168                         | 168      | 176      | 182      | 195      | 198      | 208      | 215      | 220      |

| Form 5           |          | Form 6 Quantitative USS |          |          |          |          |          |          |          |          |
|------------------|----------|-------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| <u>Raw score</u> | <u>1</u> | <u>2</u>                | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> | <u>G</u> | <u>H</u> |
| 39               | 200      | 171                     | 169      | 178      | 184      | 196      | 200      | 210      | 217      | 221      |
| 40               | 229      | 174                     | 171      | 179      | 185      | 197      | 201      | 211      | 218      | 223      |
| 41               |          | 177                     | 172      | 180      | 186      | 199      | 203      | 213      | 219      | 224      |
| 42               |          | 181                     | 173      | 182      | 188      | 201      | 205      | 214      | 221      | 225      |
| 43               |          | 186                     | 175      | 184      | 189      | 202      | 207      | 215      | 222      | 227      |
| 44               |          | 191                     | 175      | 185      | 190      | 204      | 208      | 217      | 224      | 228      |
| 45               |          | 199                     | 177      | 187      | 192      | 205      | 210      | 218      | 226      | 230      |
| 46               |          | 207                     | 178      | 189      | 194      | 206      | 212      | 220      | 227      | 232      |
| 47               |          | 219                     | 180      | 191      | 197      | 208      | 215      | 221      | 229      | 233      |
| 48               |          | 242                     | 182      | 193      | 199      | 210      | 217      | 223      | 230      | 235      |
| 49               |          |                         | 183      | 195      | 202      | 211      | 220      | 225      | 233      | 237      |
| 50               |          |                         | 185      | 197      | 205      | 213      | 223      | 227      | 235      | 239      |
| 51               |          |                         | 187      | 199      | 210      | 216      | 225      | 229      | 237      | 242      |
| 52               |          |                         | 189      | 202      | 214      | 218      | 229      | 231      | 240      | 244      |
| 53               |          |                         | 191      | 205      | 219      | 221      | 232      | 234      | 243      | 247      |
| 54               |          |                         | 194      | 208      | 224      | 224      | 236      | 238      | 246      | 250      |
| 55               |          |                         | 197      | 212      | 231      | 227      | 240      | 242      | 249      | 252      |
| 56               |          |                         | 200      | 216      | 239      | 232      | 244      | 248      | 254      | 256      |
| 57               |          |                         | 205      | 223      | 250      | 238      | 251      | 255      | 260      | 260      |
| 58               |          |                         | 211      | 231      | 264      | 249      | 258      | 269      | 269      | 265      |
| 59               |          |                         | 219      | 241      | 266      | 273      | 269      | 287      | 281      | 270      |
| 60               |          |                         | 252      | 259      | 266      | 273      | 279      | 287      | 295      | 282      |



**NONVERBAL Battery**

| Form 5           | Form 6 Nonverbal USS |          |          |          |          |          |          |          |          |          |
|------------------|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <u>Raw Score</u> | <u>1</u>             | <u>2</u> | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> | <u>G</u> | <u>H</u> |
| 0                | 49                   | 66       | 82       | 89       | 96       | 102      | 107      | 113      | 118      | 124      |
| 1                | 73                   | 99       | 97       | 113      | 107      | 123      | 124      | 113      | 139      | 128      |
| 2                | 80                   | 106      | 111      | 119      | 125      | 131      | 137      | 142      | 148      | 151      |
| 3                | 86                   | 110      | 118      | 122      | 133      | 138      | 143      | 152      | 154      | 162      |
| 4                | 91                   | 114      | 124      | 126      | 138      | 142      | 148      | 158      | 158      | 167      |
| 5                | 96                   | 117      | 128      | 130      | 142      | 146      | 152      | 161      | 162      | 172      |
| 6                | 99                   | 120      | 131      | 133      | 146      | 150      | 154      | 164      | 165      | 175      |
| 7                | 102                  | 123      | 134      | 135      | 149      | 153      | 157      | 167      | 168      | 179      |
| 8                | 106                  | 125      | 136      | 138      | 151      | 156      | 159      | 169      | 170      | 181      |
| 9                | 109                  | 127      | 139      | 140      | 154      | 159      | 162      | 171      | 173      | 183      |
| 10               | 112                  | 129      | 141      | 143      | 156      | 162      | 164      | 172      | 175      | 184      |
| 11               | 114                  | 131      | 143      | 145      | 158      | 163      | 165      | 174      | 177      | 186      |
| 12               | 117                  | 133      | 144      | 148      | 159      | 165      | 166      | 175      | 179      | 187      |
| 13               | 119                  | 135      | 146      | 150      | 161      | 167      | 168      | 177      | 180      | 189      |
| 14               | 122                  | 137      | 147      | 152      | 162      | 169      | 170      | 178      | 182      | 190      |
| 15               | 124                  | 139      | 149      | 154      | 163      | 171      | 171      | 180      | 184      | 191      |
| 16               | 126                  | 141      | 150      | 156      | 165      | 172      | 172      | 181      | 185      | 192      |
| 17               | 128                  | 143      | 151      | 158      | 166      | 173      | 174      | 182      | 187      | 193      |
| 18               | 130                  | 145      | 153      | 160      | 167      | 174      | 175      | 183      | 188      | 194      |
| 19               | 132                  | 147      | 154      | 162      | 169      | 176      | 176      | 185      | 189      | 195      |
| 20               | 134                  | 148      | 155      | 163      | 169      | 177      | 177      | 185      | 190      | 196      |
| 21               | 136                  | 150      | 156      | 164      | 170      | 178      | 178      | 186      | 191      | 197      |
| 22               | 137                  | 152      | 158      | 166      | 171      | 179      | 179      | 187      | 192      | 198      |
| 23               | 139                  | 155      | 159      | 167      | 173      | 180      | 180      | 188      | 193      | 199      |
| 24               | 141                  | 157      | 160      | 168      | 174      | 181      | 182      | 190      | 194      | 199      |
| 25               | 143                  | 158      | 160      | 169      | 175      | 182      | 183      | 191      | 195      | 200      |
| 26               | 145                  | 160      | 161      | 170      | 176      | 183      | 184      | 192      | 196      | 201      |
| 27               | 147                  | 162      | 162      | 171      | 177      | 184      | 185      | 193      | 197      | 202      |
| 28               | 149                  | 165      | 163      | 172      | 178      | 184      | 186      | 194      | 198      | 203      |
| 29               | 151                  | 166      | 165      | 174      | 179      | 185      | 187      | 195      | 199      | 204      |
| 30               | 153                  | 168      | 166      | 175      | 179      | 186      | 188      | 196      | 200      | 205      |
| 31               | 155                  | 170      | 167      | 176      | 180      | 187      | 189      | 197      | 201      | 205      |
| 32               | 157                  | 171      | 167      | 176      | 181      | 188      | 190      | 198      | 202      | 206      |
| 33               | 160                  | 173      | 168      | 177      | 182      | 188      | 191      | 199      | 203      | 207      |
| 34               | 163                  | 175      | 169      | 178      | 183      | 189      | 192      | 200      | 203      | 207      |
| 35               | 165                  | 177      | 170      | 179      | 184      | 191      | 193      | 201      | 204      | 208      |
| 36               | 169                  | 179      | 171      | 180      | 185      | 192      | 194      | 202      | 205      | 209      |
| 37               | 172                  | 181      | 172      | 181      | 186      | 193      | 195      | 203      | 206      | 210      |
| 38               | 177                  | 183      | 173      | 181      | 187      | 193      | 197      | 203      | 207      | 210      |
| 39               | 186                  | 185      | 175      | 182      | 189      | 194      | 198      | 204      | 208      | 211      |
| 40               | 229                  | 187      | 176      | 183      | 190      | 195      | 199      | 205      | 209      | 212      |

| Form 5           | Form 6 Nonverbal USS |          |          |          |          |          |          |          |          |          |
|------------------|----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <u>Raw Score</u> | <u>1</u>             | <u>2</u> | <u>A</u> | <u>B</u> | <u>C</u> | <u>D</u> | <u>E</u> | <u>F</u> | <u>G</u> | <u>H</u> |
| 41               |                      | 190      | 177      | 184      | 191      | 196      | 200      | 206      | 209      | 213      |
| 42               |                      | 192      | 178      | 185      | 191      | 197      | 201      | 207      | 210      | 213      |
| 43               |                      | 195      | 178      | 186      | 192      | 198      | 202      | 209      | 211      | 214      |
| 44               |                      | 198      | 179      | 187      | 193      | 199      | 203      | 210      | 212      | 216      |
| 45               |                      | 203      | 181      | 189      | 194      | 200      | 204      | 211      | 213      | 217      |
| 46               |                      | 209      | 182      | 190      | 196      | 201      | 205      | 212      | 214      | 218      |
| 47               |                      | 222      | 183      | 191      | 197      | 202      | 205      | 212      | 216      | 218      |
| 48               |                      | 249      | 184      | 192      | 198      | 204      | 207      | 214      | 217      | 219      |
| 49               |                      |          | 185      | 193      | 199      | 205      | 208      | 215      | 218      | 220      |
| 50               |                      |          | 187      | 195      | 201      | 206      | 209      | 216      | 220      | 221      |
| 51               |                      |          | 189      | 196      | 202      | 208      | 210      | 217      | 221      | 222      |
| 52               |                      |          | 191      | 198      | 204      | 209      | 212      | 218      | 223      | 223      |
| 53               |                      |          | 192      | 200      | 206      | 211      | 213      | 220      | 225      | 225      |
| 54               |                      |          | 194      | 202      | 207      | 213      | 214      | 221      | 227      | 227      |
| 55               |                      |          | 195      | 204      | 209      | 215      | 215      | 222      | 229      | 228      |
| 56               |                      |          | 198      | 207      | 211      | 217      | 216      | 223      | 232      | 230      |
| 57               |                      |          | 200      | 210      | 213      | 220      | 218      | 225      | 235      | 233      |
| 58               |                      |          | 203      | 213      | 216      | 222      | 219      | 227      | 237      | 236      |
| 59               |                      |          | 205      | 218      | 219      | 225      | 221      | 229      | 240      | 239      |
| 60               |                      |          | 207      | 221      | 222      | 228      | 223      | 231      | 244      | 242      |
| 61               |                      |          | 211      | 226      | 226      | 233      | 226      | 233      | 248      | 247      |
| 62               |                      |          | 215      | 233      | 230      | 237      | 229      | 237      | 253      | 251      |
| 63               |                      |          | 221      | 242      | 237      | 242      | 232      | 241      | 258      | 258      |
| 64               |                      |          | 228      | 255      | 248      | 250      | 237      | 252      | 265      | 265      |
| 65               |                      |          | 240      | 264      | 269      | 273      | 249      | 285      | 290      | 279      |