



TRAINING CENTER

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WELCOME WE ARE GLAD YOU ARE HERE

Hello,

We at PEAK are happy to provide this Field Guide for our polygraph community. It is full of useful information and reminders for examiners in the field. We hope that it will help examiners to best use the testing techniques and tools available today.

PEAK Credibility Assessment Training Center is accredited by the American Polygraph Association and recognized by the American Association of Police Polygraphists. We offer the Basic Examiner's Course as well as Advanced and PCSOT Courses. In addition, we offer online courses on various advanced polygraph topics with our library of courses expanding.

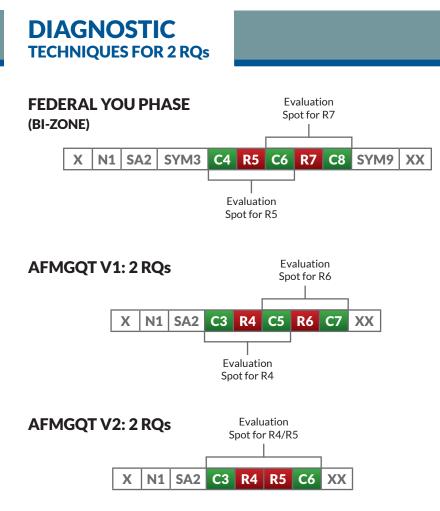
If you are looking for more training, be sure to visit us at www.peakcatc.com for a complete list of all our courses!

Best Regards,

Sandy Dunn Director PEAK Credibility Assessment Training Center sandy@peakcatc.com

Tel: (863) 944-1256





REVIEW ORDER

- RQs, SA
- CQs
- N
- SYMs (when applicable)

If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

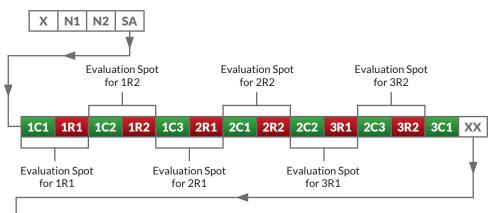
ESS-M DECISION RULES AND CUTSCORES

alpha = .05/.05, including correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less grand total is DI. Otherwise, -7 or less in any subtotal is DI. If neither is DI, move to Stage 2.

Stage 2: (Look for truthfulness): +3 or greater grand total, exam is NDI. All else is INC.

DIRECTED LIE DIAGNOSTIC TEST (DLDT)



FOURTH PRESENTATION (EXTENDED CHART)*

4R1 3C2 4R2 3C3 XX

* Three usable/interpretable presentations of each RQ are required for analysis. A presentation is usable if data are interpretable/scorable for at least 2 of the recording sensors; The Fourth Presentation is used only when needed to obtain 3 scorable iterations of each RQ. If a Fourth Presentation (Extended Chart) is collected, compare 4R1 to 3C1 and 4R2 to 3C2.

REVIEW ORDER

- RQs, SA
- CQs
- Ns

ESS-M DECISION RULES AND CUTSCORES

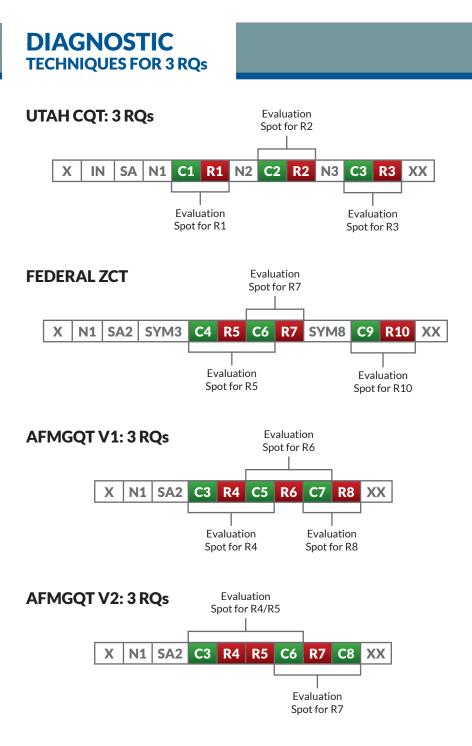
alpha = .05/.05, including correction at .05 for multiplicity at stage 1

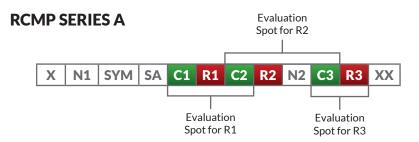
Stage 1 (Look for deception): -3 or less grand total is DI. Otherwise, -7 or less in any subtotal is DI. If neither is DI, move to Stage 2.

Stage 2: (Look for truthfulness): +3 or greater grand total, exam is NDI. All else is INC.

INCONCLUSIVE OUTCOMES

Repeating a test is optional when you have an INC test. Thoroughly re-interview and review all test questions again before repeating the test. If either of the RQs are reworded, then PEAK suggests using different DLCs.





REVIEW ORDER

- RQs, SA
- CQs
- Ns
- IN or SYMs (when applicable)

If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

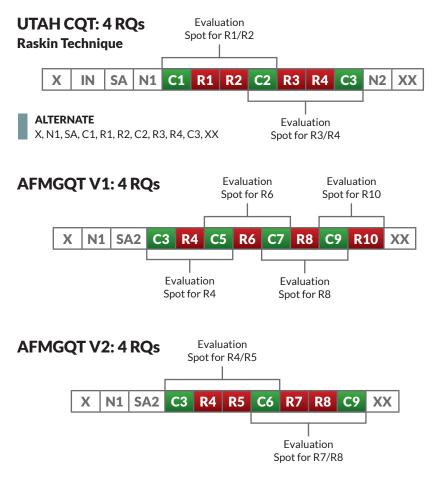
ESS-M DECISION RULES AND CUTSCORES

alpha = .05/.05, including correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less grand total is DI. Otherwise, -7 or less in any subtotal is DI. If neither is DI, move to Stage 2.

Stage 2: (Look for truthfulness): +3 or greater grand total, exam is NDI. All else is INC.





REVIEW ORDER

- RQs, SA
- CQs
- N
- IN (when applicable)

If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

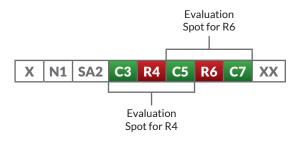
ESS-M DECISION RULES AND CUTSCORES

alpha = .05/.05, including correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less grand total is DI. Otherwise, -7 or less in any subtotal is DI. If neither is DI, move to Stage 2.

Stage 2: (Look for truthfulness): +3 or greater grand total, exam is NDI. All else is INC.

BRITISH ONE ISSUE SCREENING TEST (BOST)



REVIEW ORDER

- RQs, SA
- CQs
- N

If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

ESS-M DECISION RULES AND CUTSCORES

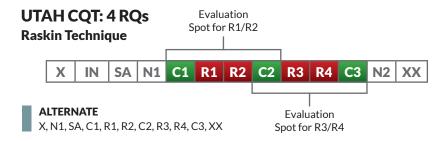
alpha = .05/.05, including correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less grand total is SR. Otherwise, -7 or less in any subtotal is SR. If neither is SR, move to Stage 2.

Stage 2 (Look for truthfulness): +3 or greater grand total, exam is NSR. All else is INC



SINGLE-ISSUE SCREENING TECHNIQUE FOR 4 RQs



REVIEW ORDER

- RQs, SA
- CQs
- N
- IN (when applicable)

If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

ESS-M DECISION RULES AND CUTSCORES

alpha = .05/.05, including correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less grand total is SR. Otherwise, -7 or less in any subtotal is SR. If neither is SR, move to Stage 2.

Stage 2: (Look for truthfulness): +3 or greater grand total, exam is NSR. All else is INC.

SELECTING A TECHNIQUE REFRESHER

- 1. Determine from the referring professional or case referral information whether a diagnostic or screening test is needed
 - **Diagnostic tests** are characterized by the presence or existence of a known problem, allegation, or incident that is under investigation. Diagnostic tests are intended to serve as a basis of information to help with decisions about how to best respond to the known problem, allegation or incident. Relevant questions for diagnostic polygraphs are interpreted with the assumption that they are dependent (non-independent). A single conclusion about the test as a whole will provide test results with the highest level of precision.
 - Screening tests are characterized by an absence of any known problem, allegation, or incident. The purpose of a screening test is to search for possible unknown problems. A screening test may be conducted as a single issue screening test, though screening tests are often more useful when they investigate multiple possible problems. Results of multiple issue screening tests are often interpreted with an assumption of independence.
- 2. Select the number of relevant questions according to the needs of the referring professional and case referral information
 - More relevant questions for diagnostic polygraphs means more data will be used to make a single classification, resulting in smaller errors of measurement and potentially increased precision.
 - More relevant questions for multiple issue screening polygraph means that multiple probability decisions support the overall test conclusion, resulting in multiple opportunities for testing error (multiplicity) and potentially less precision compared to single issue exam formats.

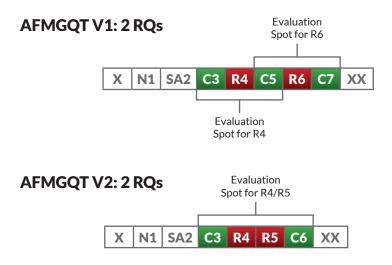
3. Select the analysis protocol (i.e., scoring method) before testing

- Manual or automated analysis for feature extraction and data reduction
- Requirements for precision and tolerance for error
- Determine the prior probability of deception or truth
- Reference model
- Decision rules that make use of grand total and/or subtotal scores



Advanced Courses

MULTIPLE-ISSUE SCREENING TECHNIQUES FOR 2 RQs



REVIEW ORDER

- RQs, SA
- CQs
- N

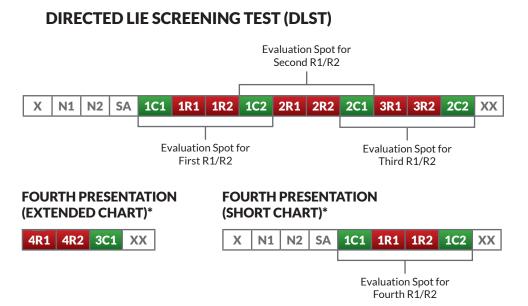
If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

ESS-M DECISION RULES AND CUTSCORES

alpha = .05/.05, including statistical correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less in any Subtotal is SR.

Stage 2 (Look for truthfulness): +1 or more in each Subtotal is NSR. All else is INC.



* Three usable/interpretable presentations of each RQ are required for analysis. A presentation is usable if data are interpretable/scorable for at least 2 of the recording sensors; The Fourth Presentation is used only when needed to obtain 3 scorable iterations of each RQ. It is not used to resolve an INC. A Fourth Presentation can be collected either as an Extended Chart or a Short Chart, but not both. If a Fourth Presentation Extended Chart is collected, compare 4R1 and 4R2 to 2C2 and 3C1.

REVIEW ORDER

- RQs, SA
- CQs
- Ns

ESS-M DECISION RULES AND CUTSCORES

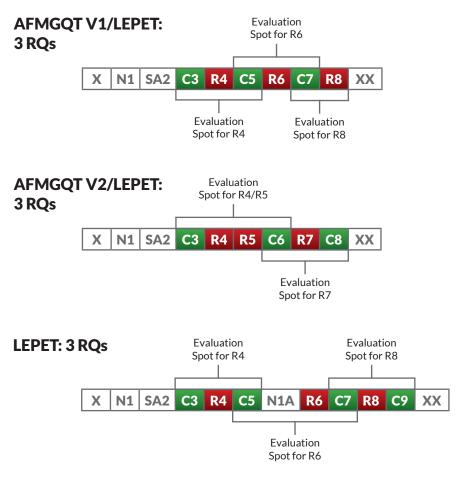
alpha = .05/.05, including statistical correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less in any Subtotal is SR.

Stage 2 (Look for truthfulness): +1 or more in each Subtotal is NSR. All else is INC.

INCONCLUSIVE OUTCOMES

Repeating a Subtest is optional when you have an INC test. Thoroughly re-interview and review all test questions again before repeating the Subtest. If either of the RQs are reworded, then PEAK suggests using different DLCs.



REVIEW ORDER

- RQs, SA
- CQs
- Ns

If allowed, rotating both CQs and RQs on each chart is recommended. If INC after three charts, add up to two additional charts.

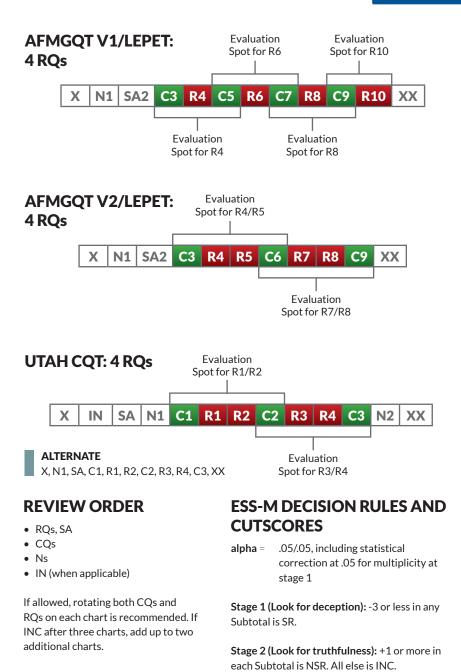
ESS-M DECISION RULES AND CUTSCORES

alpha = .05/.05, including statistical correction at .05 for multiplicity at stage 1

Stage 1 (Look for deception): -3 or less in any Subtotal is SR.

Stage 2 (Look for truthfulness): +1 or more in each Subtotal is NSR. All else is INC.

MULTIPLE-ISSUE SCREENING TECHNIQUES FOR 4 RQs



ESS-MULTINOMIAL (ESS-M) GUIDE

Multinomial tables are available for grand total scores and multiplicity-corrected subtotals for test formats with 2, 3, and 4 RQs, with and without the vasomotor sensor. Use of the multinomial reference tables differ slightly from the use of the original ESS reference tables. Statistical results using the ESS-M and Bayesian analysis can be thought of as a posterior estimate of deception or truth-telling. **Each of the following steps can be quickly and easily accomplished using the LXSoftware ESS-M Report Generator included in LXSoftware 11.8+**

VIEW ONLINE REFERENCE TABLES: https://www.polygraph.org/reference-tables

BEFORE CONDUCTING THE EXAM

- 1. Locate the ESS-M reference table for the sensors and the number of RQs in the test question format
 - ESS-M reference tables are available with and without the vasomotor sensor.
 - ESS-M tables are the likelihood function (that provides a statistical value for the test scores). Three of the table columns are of interest to field polygraph examiners.
 - score: the grand total or subtotal ESS-M score
 - **odds**: The odds of deception or odds of truth-telling are the likelihood function for a Bayesian analysis of the posterior probability or posterior odds of deception or truth-telling. The odds can also be though of as the Bayes factor or the posterior odds when the prior odds are 1 to 1.
 - **oddsLL05**: is the .05th percentile lower-limit of the Bayesian credible interval for the posterior odds of deception or truth telling. The lower limit of the credible interval determines the numerical cutscore and tells us the level of significance for a categorical test result.

2. Determine the alpha boundaries and numerical cutscores.

- Alpha is commonly set at .05
 - Use the oddsLL05 column and locate the largest lower limit value that is greater than the prior odds (prior is usually 1 to 1, unless other high quality information is available). Then determine the cutscore by selecting the value from the score column. Locate the lower limit odds and cutscores for deceptive and truthful scores. Use the table for a single RQ to determine subtotal cutscores using the columns for the multiplicity-corrected odds with 2, 3 and 4 RQs.
 - Alpha is an administrative decision, often not determined by field practitioners
 - Alpha = .01 for increased precision (may increase inconclusive results).
 - Alpha = .10 for decreased inconclusive results (may increase error rate)

AFTER CONDUCTING AND SCORING THE EXAM

- 3. Calculate the posterior probability and lower limit using the correct reference table for the number of RQs in the test format.
 - Using the correct reference table, locate the row for the grand total in the score column and determine the posterior odds using the same row in the odds column.

- Use the table for a single RQ when using subtotal scores. The odds and oddsLL05 columns include statistical correction for both truthful and deceptive classifications.
- 4. Interpret the result (translate the numerical and statistical result into usable human language).
 - A complete interpretation of the test result will provide sufficient information to reproduce the analytic conclusion.
 - Method of analysis
 - Input parameters for probabilistic inference (i.e., prior and alpha)
 - An explanation of the procedural decision rules used to obtain the probabilistic and categorical results from the grand total or subtotal scores.
 - Numerical scores (grand total or subtotal) used to determine the probabilistic and categorical result
 - Bayes factor allows recalculation of the analytic results with a different prior and alpha
 - Posterior odds of deception or truth-telling (or posterior probability)
 - Lower limit of the Bayesian credible interval for the posterior odds of deception or truth- telling (or posterior probability)
 - Use of any statistical correction for multiplicity when using subtotal scores
 - An explanation of the empirical and scientific meaning of the test result.
 - Categorical test result (DI/SR or NDI/NSR)

ESS-M CUTSCORES

Table 1: Event-Specific Exams

ESS-M Cutscores for grand total scores of event-specific exams using the multinomial reference distributions with a one-tailed alpha = .05 for the lower limit of the Clopper-Pearson interval for positive and negative classifications (multiplicity-corrected subtotal cutscores in parenthesis).

	2 RQs	3RQs	4RQs
Respiration, EDA, Cardio	+3/-3 (-7)	+3/-3 (-7)	+3/-3 (-7)
Respiration, EDA, Cardio, Vasomotor	+3/-3 (-7)	+3/-3 (-7)	+3/-3 (-7)

Table 2: Multiple-Issue Exams

ESS-M Cutscores for subtotal scores of multiple-issue exams using the multinomial reference distributions with a one-tailed alpha = .05 for the lower limit of the Clopper-Pearson interval without statistical correction for positive classifications and with statistical correction for negative classifications.

	2 RQs	3RQs	4RQs
Respiration, EDA, Cardio	+1/-3	+1/-3	+1/-3
Respiration, EDA, Cardio, Vasomotor	+1/-3	+1/-3	+1/-3

ESS-M: SCORING FEATURES

RESPIRATORY FEATURES*

- Decrease in respiration amplitude for three or more respiratory cycles, beginning after the stimulus onset
- Slowing of respiration rate for three or more respiratory cycles, beginning after the stimulus onset
- Temporary increase in respiratory baseline for three or more respiratory cycles, beginning after the stimulus onset
- * Note that a decrease in respiratory activity has been demonstrated to reliably be captured by respiration line excursion from stimulus onset and for 15 seconds, even more so than by the use of pattern recognition. Of further interest, evidence seems to suggest that there is a substantial covariance between temporary increase in respiratory baseline and decrease in respiration amplitude, suggesting these patterns may be redundant.

EDA FEATURE

• Electrodermal response amplitude

CARDIO FEATURE

• Increase in relative blood pressure (could be measured at baseline, mid, or systolic)

FINGER PULSE AMPLITUDE FEATURE

• Constriction (decrease) in the fingertip pulse amplitude

SCORING

Assign values of +, -, or 0 using the 3-position scale and the bigger-is-better rule

- Score any difference in response magnitude
- Use Primary Features only
- For each component sensor, score each RQ against the comparison question that produced the greatest change in physiological activity
- EDA should be scored as +2, -2, or 0

Score only timely reactions

- Do not score reactions that begin before the stimulus
- Do not score reactions that begin more than 5 seconds after a timely answer

Score only stable and non-artifacted data

- Do not attempt to score data that are affected by movement artifacts
- Do not attempt to score messy or unstable segments of data
- Do not attempt to score data of unusual response quality (dampened or exaggerated)
 - e.g., abnormally slow or very fast breathing



WHAT IS IT?

ESS-M (Empirical Scoring System – Multinomial) is an important update to the Empirical Scoring System.

WHERE DID IT COME FROM?

Science and scientific testing are a process of continuous research and study. The ESS-M is a product of ongoing development and research with the ESS, made possible by Lafayette Instrument Company.

WHY DO WE NEED IT?

ESS-M advances the polygraph in several ways. First, the ESS-M reference model is calculated under the analytic theory to the polygraph, and this is an answer to scientific criticism about the lack of a basic theory (which can be expressed mathematically). The ESS-M reference model serves as the likelihood function for the Bayesian analysis of polygraph results. Bayesian analysis, together with the use of odds as the statistical metric of interest, can provide for simpler and more intuitive discussion (compared to the difficult intuition for frequentist p-values) about the effect size of practical interest - the likelihood of deception or truth-telling. Finally, whereas the original ESS reference model did not include the vasomotor recording sensor, Bayesian analysis, together with the multinomial reference model, makes it possible to calculate the reference tables both with and without the additional vasomotor sensor.

HOW DO WE USE IT?

Use of the ESS-M is virtually identical to the original ESS in terms of scoring features, score assignment, and decision rules. Improvements are mainly in the scientific, theoretic, and analytic foundations of the ESS-M reference model. For practical purposes only, the ESS-M cutscores have changed. Information in this guide explains the multinomial reference tables for those who are interested. For convenience, Lafayette's LXSoftware includes a fully-featured ESS-M Report Generator that can automate the routine tasks associated with summarizing scores, executing decision rules, determining categorical and probabilistic results, and formatting a written narrative summary report.

IS IT VALID?

Multiple experiments with archival datasets have shown the ESS-M to perform as well or better than the original ESS with event-specific/diagnostic exams and multiple-issue screening exams with 2, 3 or 4 relevant questions.

REFERENCES

Nelson, R. (2017). Multinomial reference distributions for the Empirical Scoring System. Polygraph and Forensic Credibility Assessment 46(2), 81-115. Nelson, R. (2016). Scientific (analytic) theory of polygraph testing. APA Magazine, 49(5), 69-82.

BAYESIAN ANALYSIS APPENDIX B

This Vocabulary and Concept Primer for Bayesian Analysis is provided to assist in learning the distinct scientific terminology used when discussing the topic of Bayesian Analysis.

BAYESIAN INFERENCE

Inference is the process of estimating a quantity of interest – referred to as an unknown parameter – that cannot be subject to deterministic observation or physical measurement. Bayesian inference involves the use of Bayes' theorem to estimate the unknown parameter.

BAYES' THEOREM

A theorem is a mathematical expression that has been subjected to extensive mathematical proof. Bayes' theorem is based on the work of Thomas Bayes and Simon Pierre Laplace and involves the use of new information to improve the confidence or reduce the uncertainty about a conclusion associated with some prior existing information.

PROBABILITY (BAYESIAN PROBABILITY)

Bayesian probability refers to the degree of belief one may hold in some knowledge or conclusion under uncertain circumstances. This is in contrast to the frequentist notion of probability, which refers to the frequency of observed occurrences among a series of repeated or repeatable possibilities. Whereas, frequentist probabilities can only be discussed with regard to events that are both observable and repeatable, Bayesian probabilities can be used with a wider range of observable and unobservable phenomena.

PRIOR PROBABILITY (PRIOR PROBABILITY DISTRIBUTION)

The prior probability represents what is known about the likelihood of different possible outcomes before a scientific test or experiment. The prior probability distribution can be based on objective or empirical information such as a base-rate or incidence rate. For example: if exactly four persons had access and opportunity to commit a crime, the prior probability will be 1 in 2, because there are 2 possible conclusions, deception or truth-telling (an inconclusive result is not a conclusion). Outcomes can also be evaluated for a range of different possible prior probabilities.

LIKELIHOOD FUNCTION

A likelihood function is a device for obtaining a statistical or likelihood value associated with some data.

POSTERIOR PROBABILITY

The posterior probability tells us the likelihood associated with a test result or conclusion. It is the combination of the prior probability, and likelihood function and test scores using Bayes' theorem.

ODDS

Odds are a convenient and intuitive way of discussing probabilistic information. We can calculate the odds for any probability or proportion. The relationship between odds and proportions (probabilities) is this:

odds = p / (1 - p)

Also, if the odds are known the proportion or probability can be calculated in this way: p = odds / (1 + odds)

Although mathematically related to probabilities, use of odds can provide clearer and more intuitively useful information for many people.

BAYES FACTOR

Bayes factor is the value with which we would multiply the prior odds to obtain the posterior odds. When the prior odds are 1 in 2, the Bayes factor will be equal to the posterior probability. Bayes factor provides useful information to people who want to replicate or inspect an analytic result in greater detail. A Bayesian credible interval tells us the range for which we can reasonably expect a parameter of interest to exist within.

CREDIBLE INTERVAL

The credible interval tells us the range of variability (i.e. how sure we are) that we can expect for an analytic result or conclusion. A credible interval is the Bayesian analog for a confidence interval in frequentist statistics.

NAIVE-BAYES

Naive-Bayes is a widely used application of Bayes' Theorem to statistical decision making, machine-learning and artificial intelligence. In this case "naive" refers to deliberate reliance on assumptions that the different sources of data (i.e. from different sensors) are independent and contribute equally to the outcome. Naive-Bayes algorithms are advantageous in that they are simpler to understand, rapid and easy to develop and often perform quite well compared to more complex classifiers.

LAFAYETTE INSTRUMENT APPENDIX C

DID YOU KNOW?

Established in 2016, PEAK Credibility Assessment Training Center is a subsidiary of Lafayette Instrument Company. Lafayette Instrument Company is the world's leading manufacturer of Polygraph instrumentation and equipment, distributing credibility assessment solutions to private examiners, government, and military organizations around the world. Lafayette offers hardware training solutions, setup assistance, equipment discounts for new departments, and a generous upgrade program that includes competitor systems.



LX6

Lafayette's flagship polygraph system, the LX6, is compatible with LXSoftware and LXEdge.

Features

- 10 data channels including an additional AUX port.
- Superior Fischer Connectors[®] brand connections rated for twice the mating cycles of competitor systems.
- Best in industry electronics and EDA.
- Selectable GSR or GSC channel.
- Recessed pneumatic ports.
- 5 year warranty.

PARAGONX

Offering high retention USB to dual channel 32 bit, the ParagonX delivers on performance, reliability, and innovation.

Features

- 9 data channels.
- Premium Brass Alloy Lemo Connectors.
- High retention USB.
- Dual Channel 32-bit.
- 625 samples per second, per channel.
- Designated PPG and movement monitoring channels.





DOWNLOADABLE SOFTWARE

Lafayette software is available for download free of charge from their website. All users are encouraged to download software. It is the best way to keep your system up to date. www.lafayettepolygraph.com/software

NEED ACCESSORIES?

Lafayette's complete line of polygraph accessories are available for sale on their website! www.lafayettepolygraph.com/products

LX6

9ft EDA with Electrodes	76640-6
Standard Kovacic Arm Cuff	76530-6
Rakes Deluxe Forearm Cuff	76531BR-6
Forearm Kovacic Arm Cuff	76531-6
Large Arm Kovacic Arm Cuff	76534-6
Wrist Kovacic Arm Cuff	76532-6
Finger (Infant Arm) Cuff	76535-6
Pump Bulb Assembly	76506-6
10ft PLE/PPG	76604-6
Blue Color-Coded Pneumo Assembly	76513-6VT
Silver Color-Coded Pneumo Assembly	76513-6VB
Activity Sensor Seat Pad	76879S-6
Activity Sensor Arm Pads	76879A-6
Activity Sensor Foot Pads	76879F-6
Masseter Headset System	76880HM

STORAGE

Component Organizer	LX-1070
Backpack	LX-1050BP
Portable Carrying Case	LX-1050

CHAIRS

Cushioned Portable Subject's Chair	76877P
Vinyl Subject's Chair with Seat, Arm,	76870VASF
and Feet Activity Sensors	
Vinyl Adjustable Arm Subjects Chair	76870V

PARAGONX

10ft EDA with Electrodes	76640-P
Standard Kovacic Arm Cuff	76530-P
Forearm Kovacic Arm Cuff	76531-P
Wrist Kovacic Arm Cuff	76532-P
Finger (Infant Arm) Cuff	76535-P
Palm Style Sphygmomanometer	6-275-0033
7ft PLE/PPG	76604-P
Upper Pneumo Assembly	76513-PB
Lower Pneumo Assembly	76513-PT
Activity Sensor Seat Pad	76879S-P
Activity Sensor Arm Pads	76879A-P
Activity Sensor Foot Pads	76879F-P

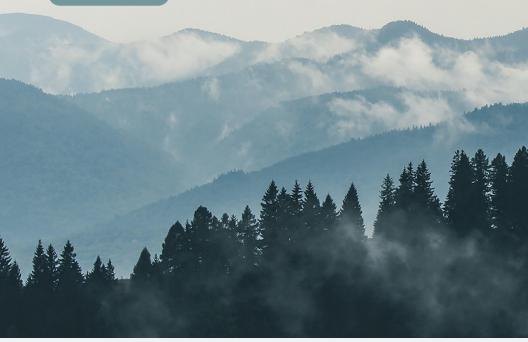
STORAGE

Pelican 1450 Case	6-240-020
Pelican 1510LOC Case	6-240-021

CHAIRS

Cushioned Portable Subject's Chair	76877P
Vinyl Adjustable Arm Subjects Chair	76870V







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