### Course Change Proposal Form A

**Academic Group (College):**
Health and Human Services

**Academic Organization (Department):**
Physical Therapy

**Date:**
2/8/2011

**Type of Course Proposal:**
New __ Change x__ Deletion __

**Department Chair:**
Dr. McGinty

**Submitted by:**
Dr. Barakatt

**Does this course fulfill a requirement for single-subject or multiple subject credential students?**
Yes ___ No x__

**For Catalog Copy:**
Yes x__ No ___

**CCE (Extension):**
Yes ___ No ___

**Semester Effective:**
Fall X__ Spring ___, 20_12___

**This course replaces experimental course Subject Area (prefix) and Catalog Nbr (course number):**

<table>
<thead>
<tr>
<th>Change from:</th>
<th>Change to:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject Area (prefix) &amp; Catalog Nbr (course no.):</strong> PT 202</td>
<td><strong>Title:</strong> Research Methods in Physical Therapy I</td>
</tr>
<tr>
<td></td>
<td><strong>Units:</strong> 2</td>
</tr>
<tr>
<td><strong>Subject Area (prefix) &amp; Catalog Nbr (course no.):</strong> PT 602</td>
<td><strong>Title:</strong> Evidence Informed Practice I</td>
</tr>
<tr>
<td></td>
<td><strong>Units:</strong> 3</td>
</tr>
</tbody>
</table>

**JUSTIFICATION:**

This course is being changed as part of the curriculum changes with the new DPT program required for continued accreditation for the program. The course has been upgraded to reflect the expectations in a doctoral program.

**NEW COURSE DESCRIPTION:** (Not to exceed 80 words, and language should conform to catalog copy. See http://www.csus.edu/umanual/acad.htm - Guidelines for Catalog Course Description)

This course is designed to teach students to critically read and interpret the physical therapy scientific literature. Topics will include research design and statistical testing procedures commonly used in the physical therapy. Students will review and critique current physical therapy articles utilizing the research designs and statistical testing procedures being studied. Open to Physical Therapy majors only.

**Note:**
- Prerequisite: None
- Enforced at Registration: Yes x__ No ___
- Corequisite: BIO 633, PT 600, PT 608, PT 630
- Enforced at Registration: Yes ___ No x__
- Graded: Letter x__ Credit/No Credit ___
- Instructor Approval Required? Yes ___ No, x__
- Course Classification (e.g., lecture, lab, seminar, discussion): Lecture C-02
- Title for CMS (not more than 30 characters)
  Evidence Informed Practice I
- Cross Listed? Yes ___ No x__
  If yes, do they meet together and fulfill the same requirement, and what is the other course?
- How Many Times Can This Course be Taken for Credit? ___ once ___
- Can the course be taken for Credit more than once during the same term? Yes ___ No x__
FOR NEW COURSE PROPOSALS OR SUBSTANTIVE CHANGES ONLY:

Description of the Expected Learning Outcomes: Describe outcomes using the following format: “Students will be able to: 1), 2), etc.” See the example at http://www.csus.edu/acaf/example.htm

All course objectives reference the overall educational goals and outcomes of the Department of Physical Therapy. At the conclusion of this course, the student is expected to be able to:

Goal 2.0: Demonstrate Professional Behaviors
2.5 Demonstrate entry level generic abilities, including:
   2.5.1 Professional accountability and commitment to learning.
   2.5.1.1 Appropriately completing and promptly turning in assignments.
   2.5.3 Effective use of constructive feedback.
   2.5.3.1 Adequately revise assignment based on feedback provide
   2.5.4 Effective use of time and resources.
   2.5.4.1 Effectively work with colleagues on scholarly activities

Goal 4.0: Demonstrate Scholarship
4.1 Apply basic principles of statistics and research methodologies within the practice of physical therapy.
   4.1.1 Formulate and reevaluate positions based on the best available evidence.
   4.1.1.a. Discuss the need for research pertaining to topics in physical therapy.
   4.1.1.b. Discuss the sources of knowledge currently being used to rationalize current physical therapy evaluation and treatment.
   4.1.3 Evaluate the efficacy and efficiency of physical therapy procedural interventions.
   4.1.3.1 Rank the strength of evidence of treatment effectiveness research articles utilizing the PEDro physical therapy evidence-based practice website criteria designed to assess a study’s strength of evidence.
   4.1.4 Critically evaluate and interpret professional literature as it pertains to practice, research, and education.
   4.1.4.1 Recognize validity and reliability issues with measurements used in the physical therapy clinic and literature
   4.1.4.2 Recognize sampling methods and how the method of sampling can effect validity of a study’s results
   4.1.4.3 Recognize multiple different type of data distributions and how the type of distribution can effect the type of analysis performed.
   4.1.4.4 Distinguish between a sample distribution and a distribution of means, and know the utilization of each.
   4.1.4.5 Describe properties of a normal distribution, compute confidence intervals about a mean of a normal distribution and interpret and the meaning of the confidence intervals.
   4.1.4.6 Recognize the appropriateness of use and interpretations of different presentations of descriptive statistics.
   4.1.4.7 Recognize the situation in which, and/or how to perform the following hypothesis tests: z-test, paired and independent t-tests, various forms of ANOVAs and associated follow-up tests, Mann-Whitney U test, Wilcoxin Sign Rank test, chi-square test, Pearson Product-Moment and Spearman Rank correlation coefficients, and linear regression.
   4.1.5 Utilize contemporary technology consistently to access evidence.
   4.1.5.1 Utilize the PEDro physical therapy evidence-based practice website to access criteria used to rank the strength of evidence of a treatment effectiveness research article.

**Attach a list of the required/recommended course readings and activities [Note: it is understood that these are updated and modified as needed by the instructor(s).] This attachment should be forwarded only to your Dean’s office, not Academic Affairs.

Assessment Strategies: A description of the assessment strategies (e.g., portfolios, examinations, performances, pre-and post-tests, conferences with students, student papers) which will be used by the instructor to determine the extent to which students have achieved the learning outcomes noted above:

<table>
<thead>
<tr>
<th>Assessment Item</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midterm examination #1</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm examination #2</td>
<td>20%</td>
</tr>
<tr>
<td>Final examination</td>
<td>20%</td>
</tr>
<tr>
<td>Quizzes (3)</td>
<td>15%</td>
</tr>
<tr>
<td>Homework Assignments:</td>
<td></td>
</tr>
<tr>
<td>Journal critiques (5 - graded)</td>
<td>20%</td>
</tr>
<tr>
<td>Problem sheets</td>
<td>5%</td>
</tr>
</tbody>
</table>
For whom is this course being developed?
Majors in the Dept  x  Majors of other Depts  ___  Minors in the Dept  ___  General Education  ___  Other  ___
Is this course required in a degree program (major, minor, graduate degree, certificate)? Yes  x  No  ___
If yes, identify program(s): DPT

Does the proposed change or addition cause a significant increase in the use of College or University resources (lab room, computer
facilities, faculty, etc.)? Yes  ___  No  x  ___
If yes, attach a description of resources needed and verify that resources are available.

Indicate which department or programs will be affected by the proposed course (if any).  ___  Physical Therapy  ___

The Department Chair's signature below indicates that affected programs have been sent a copy of this proposal form.

Approvals: If proposed change, new course or deletion is approved, sign and date below. If not approved, forward without signing to
the next reviewing authority, and attach an explanatory memorandum to the original copy.

<table>
<thead>
<tr>
<th>Signatures:</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department Chair:</td>
<td></td>
</tr>
<tr>
<td>College Dean or Associate Dean:</td>
<td></td>
</tr>
<tr>
<td>CPSP (for school personnel courses ONLY)</td>
<td></td>
</tr>
<tr>
<td>Associate Vice President</td>
<td></td>
</tr>
<tr>
<td>and Dean for Academic Programs</td>
<td></td>
</tr>
</tbody>
</table>

Distribution: Academic Affairs (original), Department Chair and College Dean. Dean's office to send original after approval to
Academic Affairs, at mail zip 6016. An electronic copy must also be sent.

9/10/2008
Fall Semester

**COURSE CREDIT:** 3 units

**INSTRUCTOR:** TBA

**LOCATION:** TBA

**TIME:** TBA

**COURSE DESCRIPTION:**
This course is designed to teach students to critically read and interpret the physical therapy scientific literature. Topics will include research design and statistical testing procedures commonly used in the physical therapy. Students will review and critique current physical therapy articles utilizing the research designs and statistical testing procedures being studied. **Open to Physical Therapy majors only.**

**CO-REQUISITES:**
- BIO 233 Review of Gross Human Anatomy
- PT 600 Pathokinesiology
- PT 608 PT/Professional Interactions
- PT 630 Pathophysiology

**REQUIRED TEXTS:**

**OPTIONAL TEXT:**

**ADDITIONAL REQUIRED READING:**
Selected articles to be identified for students in class as required.

**MATERIALS:**
Each student is responsible for obtaining access to a scientific or business calculator for use during examinations. Homework activities will be performed on personal computers using the spreadsheet software of your choice. These activities can be done on your own personal computer (if you have appropriate software), or in the Solano 3003 PT student computer lab where MS Excel is available to you.
**COURSE OBJECTIVES:**
All course objectives reference the overall educational goals and outcomes of the Department of Physical Therapy.

At the completion of this course, the student is expected to be able to:

**Goal 2.0:** **Demonstrate Professional Behaviors**

2.5 Demonstrate entry level generic abilities, including:

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4.1.5 Utilize contemporary technology consistently to access evidence.

4.1.5.1 Utilize the PEDro physical therapy evidence-based practice website to access criteria used to rank the strength of evidence of a treatment effectiveness research article.

TEACHING STRATEGIES AND LEARNING ACTIVITIES:
1. Lectures, demonstrations and discussion led by instructor
2. Homework assignments utilizing SacCT
3. Research article critiques
4. Examples from the required text book
5. Practice problems performed in class and independently (answers provided)

GRADING PROCEDURES: Be specific—students will hold you to these, as they should. This syllabus is your contract with students.

Grading:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>94-100%</td>
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<tr>
<td>A-</td>
<td>90-93%</td>
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<tr>
<td>B+</td>
<td>87-89%</td>
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<tr>
<td>B</td>
<td>83-86%</td>
</tr>
<tr>
<td>B-</td>
<td>80-82%</td>
</tr>
<tr>
<td>C+</td>
<td>77-79%</td>
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<tr>
<td>C</td>
<td>73-76%</td>
</tr>
<tr>
<td>C-</td>
<td>70-72%</td>
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<tr>
<td>D+</td>
<td>67-69%</td>
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<tr>
<td>D</td>
<td>63-66%</td>
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<tr>
<td>D-</td>
<td>60-62%</td>
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<tr>
<td>F</td>
<td>59% &amp; below</td>
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</tbody>
</table>

Midterm examination #1  20%
Midterm examination #2  20%
Final examination       20%
Quizzes (3)             15%
Homework Assignments:
  Journal critiques (5 - graded)  20%
  Problem sheets             5%

Written examinations will be in the form of problem solving, essay and short answer. Examination questions will be drawn from information presented in class. Homework will be assigned as scheduled in the syllabus and will be completed using the “Assignment” function on WebCT. Students will be graded on the accuracy of their homework assignments. No late homework will be accepted.

Attendance: Daily attendance and timeliness is expected. Courtesy and professional responsibility requires notification of the instructor for any absence in advance. Students are responsible for any missed work and may be required to complete make-up assignments.
**Behavioral expectations:** Students are responsible for appropriate behaviors as defined by the generic abilities. Failure to comply with behavioral expectations during class may result in a student first being warned that behavior is inappropriate, then, if inappropriate behavior continues, a student may be asked to leave a class. Repeated failure to comply with behavioral expectations can lead to failure in the course. Cell phones and beepers should be off or silent (set to vibration mode) during the class. No text messaging is permitted in class.

**Special accommodations:** During the course of the year, some students may utilize prearranged accommodations. If you are a student with a learning disability, physical disability, or other special needs, please let me know as soon as possible if you need special accommodation. These kinds of confidential discussions are best handled during my office hours or by special appointment. You can expect confidentiality and cooperation regarding any circumstances and needs that have been verified though the Office of Services to Students with Disabilities (SSWD).

**MAJOR ASSIGNMENTS:**
See SacCT for all problem sheet and article critique assignments associated with this course.

**TENTATIVE SCHEDULE:**
Homework assignments due dates may be modified during the course of the semester. All dates below are tentative. P&W = the Portney and Watkins text book

<table>
<thead>
<tr>
<th>Dates</th>
<th>Topics, Assignments, Quizzes, Exams</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1:</td>
<td>Introduction, sampling techniques, reliability concepts, statistical tests of reliability commonly used in physical therapy</td>
<td>P&amp;W Chapters 1, 5, 8</td>
</tr>
<tr>
<td>Week 2:</td>
<td>Types of validity, biases common in physical therapy investigations, types of measurement scales utilized in physical therapy, variable types</td>
<td>P&amp;W Chapters 4 &amp; 6</td>
</tr>
<tr>
<td></td>
<td><strong>Homework:</strong> Journal Article Worksheet #1</td>
<td></td>
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<tr>
<td>Week 3:</td>
<td>Descriptive statistics typically utilized in the physical therapy literature, properties of normal distributions</td>
<td>P&amp;W Chapter 4</td>
</tr>
<tr>
<td></td>
<td><strong>Quiz #1</strong></td>
<td></td>
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<tr>
<td></td>
<td><strong>Homework:</strong> Problem Sheet #1</td>
<td></td>
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<tr>
<td>Week 4:</td>
<td>Properties of normal distributions, confidence intervals of estimates.</td>
<td>P&amp;W Chapter 17</td>
</tr>
<tr>
<td>Week 5:</td>
<td>Formulating the clinical research hypotheses, inference vs. prediction, probability distributions</td>
<td>P&amp;W Chapters 17 &amp; 18</td>
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<tr>
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<td><strong>Homework:</strong> Journal Article Worksheet #2</td>
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<tr>
<td>Week 6:</td>
<td>Hypothesis testing applications in physical therapy, the use of the z-test in the physical therapy literature.</td>
<td>P&amp;W Chapter 18</td>
</tr>
<tr>
<td></td>
<td><strong>Examination #1</strong></td>
<td></td>
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<tr>
<td></td>
<td><strong>Homework:</strong> Problem sheet #2</td>
<td></td>
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<tr>
<td>Week 7:</td>
<td>z-tests, statistical power, and types of error in inference testing applied to physical therapy topics, hypothesis testing, z-tests, statistical error types</td>
<td>P&amp;W Chapter 18</td>
</tr>
<tr>
<td>Week</td>
<td>Topic</td>
<td>Assignment</td>
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</tr>
<tr>
<td>8</td>
<td>Hypothesis testing applications in physical therapy, the use of t-tests in the physical therapy literature.</td>
<td>Homework: Journal Article Worksheet #3</td>
</tr>
<tr>
<td>9</td>
<td>Hypothesis testing applications in physical therapy, the use of ANOVAs and follow-up tests in the physical therapy literature.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Hypothesis testing applications in physical therapy, the use of ANOVAs and follow-up tests in the physical therapy literature</td>
<td></td>
</tr>
</tbody>
</table>
| 11    | Topic: Non-parametric testing applications in physical therapy, the use of non-parametric tests in the physical therapy literature. | Examination #2  
Homework: Problem sheet #4 ANOVAs                                      | P&W Chapter 22 |
| 12    | Chi square (frequency testing) applications in physical therapy, correlation applications in physical therapy, |                                                                       | P&W Chapters 23 & 25 |
| 13    | The use of correlation in the physical therapy literature. Thanksgiving Break |                                                                       | P&W Chapters 23 & 25 |
| 14    | Regression analysis applications in physical therapy, the use of regression in the physical therapy literature | Quiz #3  
Homework: Problem sheet (5)                                             | P&W Chapter 24, Jewel 214 |
| 15    | Review of selected topics  
Homework: Problem sheet #6  
Homework: Journal article worksheet (5)  
Course evaluations |                                                                       |             |
| 16    | **FINAL EXAMINATION**                                              |                                                                       |             |

**THE SCHEDULE AND CONTENT OF THE SYLLABUS ARE SUBJECT TO CHANGE AT THE DISCRETION OF THE INSTRUCTOR.**

**STUDENTS SHOULD READ AND BECOME FAMILIAR WITH THE UNIVERSITY’S ACADEMIC HONESTY, POLICY & PROCEDURES WHICH CAN BE FOUND AT:**

[www.csus.edu/admbus/umanual/UMA00150.htm](http://www.csus.edu/admbus/umanual/UMA00150.htm)  

The following are direct quotes from the first sections of that document:

"The principles of truth and honesty are recognized as fundamental to a community of scholars and teachers. California State University, Sacramento (CSUS) expects that both faculty and students will honor these principles, and in so doing, will protect the integrity of academic work and student grades. CSUS is a publicly-assisted institution legislatively empowered to certify competence and accomplishment in general and discrete categories of knowledge. The President
and faculty of CSUS are therefore obligated not only to the world at large but also to California to guarantee that substantive knowledge is actually acquired and the ability to acquire it is actually demonstrated by those to whom they assign grades and whom they recommend for degrees. Academic dishonesty defrauds all those who depend upon the integrity of the University, its courses and its degrees. This fraud is accomplished to the extent that faculty, students or campus employees knowingly or unwittingly allow academic dishonesty to work its deception.”

“....Plagiarism is a form of cheating. At CSUS plagiarism is the use of distinctive ideas or works belonging to another person without providing adequate acknowledgement of that person’s contribution. Regardless of the means of appropriation, incorporation of another’s work into one’s own requires adequate identification and acknowledgement. Plagiarism is doubly unethical because it deprives the author of rightful credit and gives credit to someone who has not earned it. Acknowledgement is not necessary when the material used is common knowledge.”
1. You are determining if a person’s vastus medialis muscle is more active while performing a straight-leg raise when the hip is in a neutral position or when the hip is in an externally rotated position. You also consider if the leg being tested is the patient’s dominant leg or non-dominant leg. The activity of the vastus medialis is measured using EMG (in microvolts – i.e. it is continuous). All test positions are performed on both legs of a sample of 60 subjects. Assume parametric requirements are met. What type of statistical analysis should be used to determine the best method to maximally activate the vastus medialis?
   A. Two-Way ANOVA, Independent Samples Design
   B. Mann-Whitney U Test
   C. One-Way ANOVA, Independent Samples Design
   D. Two-Way ANOVA, Repeated Measures Design
   E. Two-Way ANOVA, Mixed Design

2. You are trying to determine if there is a difference in throwing distance (measured in meters) based on hand dominance. A group of 30 left-handers is compared to a group of 50 right-handers. The distance thrown by the dominant throwing arm of each group is measured. Assume parametric requirements are met. What type of statistical test should you use?
   A. Chi-square Statistic
   B. t-test for Independent Samples
   C. Wilcoxon Signed Rank Test
   D. Mann-Whitney U Test
   E. Paired t-test

3. You are trying to determine if there is a difference in throwing distance (measured in meters) based on hand dominance. A group of 30 left-handers is compared to a group of 50 right-handers. The distance thrown by the dominant throwing arm of each group is measured. Assume parametric requirements are not met. What type of statistical test should you use?
   A. Chi-square Statistic
   B. t-test for Independent Samples
   C. Wilcoxon Signed Rank Test
   D. Mann-Whitney U Test
   E. Paired t-test

4. You are trying to determine the most effective treatment for headaches reproduced by pressure applied to the soft tissue over the C-1 vertebra. A group of 50 subjects receives an electrical stimulation treatment designed to decrease headaches. Another group of 50 subjects receives a massage/mobilization treatment. Another 50 subjects is given a booklet describing the benefits of good posture. The outcome variable is degree of headache pain reduction experienced over a two-week period as measured with a visual analogue scale. Parametric requirements are met. What type of statistical test should you use?
   A. Two-Way ANOVA, Repeated Measures Design
   B. z-test
   C. One-Way ANOVA, Independent Samples Design
   D. Mann-Whitney U Test
   E. Paired t-test
5. You are identifying the relationship between manual muscles test ratings of knee extension (an ordinal measure) and age. What type of statistical analysis should be used to assess the strength of the relationship?
   A. Wilcoxon Signed Rank Test
   B. Linear Regression Analysis
   C. Chi-square statistic
   D. Spearman’s Correlation Coefficient
   E. Pearson’s Correlation Coefficient

6. You are determining if there is an association between outcome success (successful vs. unsuccessful) and the type of neurological treatment approach used by physical therapists (Task Oriented Approach vs. Neuro-Developmental Training). What type of statistical test should you use?
   A. Chi-square Statistic
   B. t-test for Independent Samples
   C. Wilcoxon Signed Rank Test
   D. Spearman’s Correlation Coefficient
   E. Paired t-test

7. You want to use your knowledge of patients’ initial disability scores (a continuous measure) to predict the number of days they will miss work in a one year period (a continuous measure). Assume parametric assumptions are met. What type of statistical test should you use?
   A. Wilcoxon Signed Rank Test
   B. Linear Regression Analysis
   C. Chi-square statistic
   D. Spearman’s Correlation Coefficient
   E. Pearson’s Correlation Coefficient

8. You have been working with patients from Roast’em Chicken Industries, Inc (RCII) that work on the thigh carving assembly line. These patients have complaints of hand, wrist, and forearm pain. From the patients’ medical charts you record the median nerve conduction velocity information on 50 of your patients following the development of their medical problem. You access pre-employment physical information and find out the true population mean of pre-employment median nerve conduction velocity of all employees of RCII. What statistical test would be appropriate to determine if your patients’ mean median nerve conduction velocities are significantly different from the known median nerve conduction velocity of the population of new employees at RCII? Parametric requirements are met.
   A. Two-Way ANOVA, Repeated Measures Design
   B. t-test for Independent Samples
   C. z-test
   D. Mann-Whitney U Test
   E. Paired t-test

9. Which of the following is the null hypothesis tested in a Spearman’s correlation coefficient analysis?
   A. \( b = 0 \)
   B. \( b = 1 \)
   C. \( r = 0 \)
   D. \( r = 1 \)
   E. \( r^2 = 0 \)
To determine if the manual muscle test grade of shoulder “scaption” is affected by gender in patients with fibromyalgia, the physical therapy students at Slack State University conducted an experiment. They recorded “scaption” manual muscle test strength grades of 30 men and 75 women, all of whom were diagnosed with fibromyalgia. Results are recorded below:

<table>
<thead>
<tr>
<th></th>
<th>MMT Grade Normal</th>
<th>MMT Grade Good</th>
<th>MMT Grade Fair</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>15 (15.4)</td>
<td>9 (8.9)</td>
<td>6 (5.7)</td>
</tr>
<tr>
<td>Female</td>
<td>39 (38.6)</td>
<td>22 (??)</td>
<td>14 (14.3)</td>
</tr>
</tbody>
</table>

10. What is the null hypothesis in this situation?
   A. b = 0
   B. r = 0
   C. There is no association between gender and MMT grade
   D. There is an association between gender and MMT grade
   E. $r^2 = 1$

11. What is the critical value for a level of significance of $\alpha = .05$?
   A. 3.84
   B. 5.99
   C. 7.82
   D. 9.49
   E. 11.07

12. What is the expected number of females with a MMT grade of good (assuming independence)?
   A. 8.9
   B. 19.1
   C. 22.1
   D. 24.5
   E. 27.3

13. What is the calculated value of the statistic used in this situation?
   A. 0.037
   B. 1.011
   C. 2.156
   D. 5.211
   E. 9.773

14. T F The probability that the null hypothesis is true in this situation is less than 5%.

15. T F There is no association between gender and manual muscle strength test for patients with fibromyalgia.
A physical therapist noticed that the strength of patients' trunk extensor muscles seemed to be related to the amount of rehabilitation time patients required prior to returning to work with minimal pain complaints. This therapist decided to determine if she could predict how long patients would be in therapy based on their initial trunk strength. So the therapist did a chart review of all low back pain patients to determine their trunk extensor strength at initial evaluation. The therapist then determined what patients' normal trunk strength should be based on normative data. Each patient's % of normal strength at initial evaluation was calculated. The number of visits the patient made to physical therapy prior to returning to work with minimal pain was also determined from the patient's chart. Parametric assumptions were met. The following is the data this therapist culled from the patients' charts:

<table>
<thead>
<tr>
<th>Trunk Strength % of Normal (X)</th>
<th># of Days in Rehab (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>33</td>
<td>29</td>
</tr>
<tr>
<td>14</td>
<td>60</td>
</tr>
<tr>
<td>54</td>
<td>22</td>
</tr>
<tr>
<td>34</td>
<td>26</td>
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<tr>
<td>23</td>
<td>51</td>
</tr>
<tr>
<td>17</td>
<td>62</td>
</tr>
<tr>
<td>76</td>
<td>12</td>
</tr>
<tr>
<td>50</td>
<td>45</td>
</tr>
<tr>
<td>41</td>
<td>30</td>
</tr>
<tr>
<td>65</td>
<td>15</td>
</tr>
<tr>
<td>46</td>
<td>35</td>
</tr>
<tr>
<td>49</td>
<td>21</td>
</tr>
<tr>
<td>59</td>
<td>5</td>
</tr>
</tbody>
</table>

Regression Equation: $\hat{y} = 66 - 0.80 \times X$

16. What is the predicted number of days a patient will be in rehab if the patient initially has 45% of normal trunk strength?
   A. $\hat{y} = 5$
   B. $\hat{y} = 10$
   C. $\hat{y} = 15$
   D. $\hat{y} = 30$
   E. $\hat{y} = 60$

17. What is the most likely correlation coefficient of this data? (See figure on the next page.)
   A. $r = 0$
   B. $r = 1.0$
   C. $r = 0.86$
   D. $r = -0.86$
   E. $r = -1.0$
18. What does the line to the right of the “A” represent in the figure below?
A. Variance in rehabilitation days due to regression for the observation
B. Variance in rehabilitation days due to error for the data set
C. Lack of variance in the correlation relationship
D. Overall variance of the days of rehabilitation data
E. Variance in rehabilitation days due to error for the observation

19. What does the line to the right of the “B” represent in the figure below?
A. Variance in rehabilitation days due to regression for the observation
B. Variance in rehabilitation days due to error for the data set
C. Lack of variance in the correlation relationship
D. Overall variance of the days of rehabilitation data
E. Variance in rehabilitation days due to random error for the observation

20. What percentage of the variance in the figure below is attributable to random error?
(note \( r^2 = \text{R Sq Linear} \))
A. 74%        B. 90%        C. 5%        D. 26%        E. 95%
ANOVA for Regression

<table>
<thead>
<tr>
<th>Source of variance</th>
<th>df</th>
<th>SS</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attributable to Regression (%</td>
<td>1</td>
<td>3119</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(% Trunk Strength)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attributable to Error</td>
<td>12</td>
<td>1100</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

21. What is the null hypothesis being tested with the ANOVA for regression?
   A. b = 0
   B. b = 1
   C. r = 0
   D. r = 1
   E. $r^2 = 0$

22. What is the calculated value of F?
   A. F = 2
   B. F = 6
   C. F = 19
   D. F = 34
   E. F = 36

23. Given a level of significance of $\alpha = .05$, what is the critical value of F for this study?
   A. Critical F= 4.96
   B. Critical F= 4.84
   C. Critical F= 4.75
   D. Critical F= 4.67
   E. Critical F= 4.10

24. T F There is a predictive relationship between trunk strength and days of rehabilitation.

25. T F The more variance that can be explained by the regression equation, the less predictive the regression equation is.

26. Which of the following best represents variance due to regression conceptually?
   A. $\sum (\hat{y} - x)^2$
   B. $\sum (\hat{y} - \bar{y})^2$
   C. $\sum (\hat{y} - \bar{y})^2$
   D. $\sum (y - \bar{y})^2$
   E. $\sum (y - x)^2$
27. If you read an article that states the correlation coefficient of the relationship between patients’ knee flexion ROM following a total knee replacement (6-weeks post op) and speed of stair climbing (measured in stairs climbed per minute) is \( r = -0.65 \), how would you describe that relationship?

A. A good relationship
B. A good inverse relationship
C. An excellent relationship
D. An excellent inverse relationship
E. A poor relationship

28. If you read further and the article states that the p-value associated with the correlation coefficient was found to be .001, what would you conclude about the correlation coefficient?

A. The correlation coefficient is significantly different than one, and describes a relationship not likely due to chance.
B. The correlation coefficient is significantly different than one, and describes a relationship that is likely due to chance.
C. The correlation coefficient is significantly different than zero, and describes a relationship not likely due to chance.
D. The correlation coefficient is significantly different than zero, and describes a relationship that is likely due to chance.
E. None of the above

Correlation matrix: Pearson’s Correlation Coefficients

<table>
<thead>
<tr>
<th></th>
<th>Height</th>
<th>Weight</th>
<th>Disability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.5</td>
<td>.16</td>
<td>.12</td>
</tr>
<tr>
<td></td>
<td>(p&gt;.05)</td>
<td>(p&gt;.05)</td>
<td>(p&gt;.05)</td>
</tr>
<tr>
<td>Height</td>
<td>.11</td>
<td></td>
<td>-.10</td>
</tr>
<tr>
<td></td>
<td>(p&gt;.05)</td>
<td></td>
<td>(p&gt;.05)</td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td>.47</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(p&lt;.05)</td>
<td></td>
</tr>
</tbody>
</table>

29. T F Based on the correlation matrix above, a person’s height has the strongest relationship with the person’s disability score.

MORE QUESTIONS ON NEXT PAGE!!!
You may recall Art Hritis, PT. He was trying to figure out if patients, status post total knee replacement (TKR) surgery, could perform active terminal knee extension better with a solid wood bolster under their involved knee or a soft foam bolster. Art decided to develop a research project that tested whether the deficit in terminal knee extension AROM (quad lag) in patients status post TKRs was smaller using the wood or soft foam bolster (Quad lag = PROM – AROM in knee extension). He measured eight patients’ quad lag using a foam bolster, and the same eight patients’ quad lag using a wood bolster. The data he collected are listed in the table below. Parametric assumptions are not met.

<table>
<thead>
<tr>
<th>Subject #</th>
<th>Quad lag using foam bolster</th>
<th>Quad lag using wood bolster</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12°</td>
<td>4°</td>
</tr>
<tr>
<td>2</td>
<td>14°</td>
<td>3°</td>
</tr>
<tr>
<td>3</td>
<td>4°</td>
<td>5°</td>
</tr>
<tr>
<td>4</td>
<td>16°</td>
<td>5°</td>
</tr>
<tr>
<td>5</td>
<td>9°</td>
<td>0°</td>
</tr>
<tr>
<td>6</td>
<td>8°</td>
<td>8°</td>
</tr>
<tr>
<td>7</td>
<td>15°</td>
<td>4°</td>
</tr>
<tr>
<td>8</td>
<td>7°</td>
<td>6°</td>
</tr>
</tbody>
</table>

30. What Statistical test should Art use?
   A. t-test for Independent Samples
   B. Wilcoxon Signed-Rank Test
   C. z-test
   D. Mann-Whitney U Test
   E. Paired t-test

31. What is the critical value for this hypothesis testing procedure?
   A. U = 13
   B. U = 15
   C. T = 2
   D. T = 4
   E. F = 4.67

32. T  F  Art should reject the null hypothesis.

33. T  F  Art should conclude that quad lag is diminished using a wood bolster.
### Critical Values

<table>
<thead>
<tr>
<th>F ((\alpha = .05))</th>
<th>(\chi^2 = .05)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\text{df}_{b\text{(reg)}})</td>
<td>(\text{df})</td>
</tr>
<tr>
<td>(\text{df}_e)</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>161</td>
</tr>
<tr>
<td>4</td>
<td>7.71</td>
</tr>
<tr>
<td>8</td>
<td>5.32</td>
</tr>
<tr>
<td>12</td>
<td>4.75</td>
</tr>
<tr>
<td>16</td>
<td>4.49</td>
</tr>
</tbody>
</table>

U (\(\alpha_2 = .05\))

- \(n_1 = 7, n_2 = 7, U = 10\)
- \(n_1 = 8, n_2 = 8, U = 13\)
- \(n_1 = 9, n_2 = 9, U = 15\)

T (\(\alpha_2 = .05\))

<table>
<thead>
<tr>
<th>(n)</th>
<th>(T)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>
After reading the article *Sensorimotor impairments and reaching performance in subjects with poststroke hemiparesis during the first few months of recovery*, (Physical Therapy 87(6), 751-765, 2007), answer the questions below. This is a complex study. Be methodical in describing the different aspects of the studies design when interpreting the results. The questions on the worksheet are structured to assist you in being methodical in dissecting this study. Unfortunately, most studies you will run into are this complex. Based on previous conversations, some of you may feel some of this assignment contains busy work…but it is important to learn to be systematic in dissecting these articles, so use your word processors to cut down on the “busy work” aspect of the assignment, and deal with a bit of redundancy in the interest of learning to be systematic.

1. This investigation has two stated purposes: what are they?
   a.
   b.

2. What were the inclusion and exclusion criteria of subjects in this study?
   a. Inclusion criteria
      i.
      ii.
      iii.
      iv.
      v.
   b. Exclusion criteria
      i.
      ii.
      iii.
      iv.

3. What upper extremity reaching performance and sensorimotor impairment measurements were measured on each subject? (Briefly explain the measurement device. Then name the measures and units they were measured in. If the measure is a scale, report the possible range of the scales scores with an interpretation for the highest and lowest score. If the measure is a ratio, what are the limits of the ratio and how they should be interpreted)
   a. Reaching performance measurements:
      i. 3-D reach kinematics with the subject in the sitting position (chest stabilized, UE starting on pillow resting on ipsilateral thigh, shoulder in neutral position, elbow flexed between 75 to 90 degrees. Subjects reached forward as fast as possible to touch a spherical object positioned 90% of the arms length away at shoulder height. Used HiRes Motion Analysis System.
         I. Measurement #1
         • Explain measurement #1
2. Measurement #2
   - Explain measurement #2

3. Measurement #3
   - Explain measurement #3

4. Measurement #4
   - Explain measurement #4

5. Measurement #5
   - Explain measurement #5

b. Sensorimotor impairments:
   1. Measurement #1
      - Explain measurement #1
   2. Measurement #2
      - Explain measurement #2
   3. Measurement #3
      - Explain measurement #3
   4. Measurement #4
      - Explain measurement #4
   5. Measurement #5
      - Explain measurement #5
   6. Measurement #6
      - Explain measurement #6
   7. Measurement #7
      - Explain measurement #7
   8. Measurement #8
      - Explain measurement #8

4. What general procedure was done on data to allow parametric tests to be performed in this investigation? Identify the procedures and what measures they were performed on.

   The general procedure are called:
   (list specific procedure per measurement below – there are 6 of them)
   
   •
   •
   •
   •
   •
   •
   •

5. There are six sections in the narrative of the Results section. Skip the first two sections titled “Reaching Performance and Sensorimotor Impairments at the Acute Time Point” and “Changes in Reaching Performance and Sensorimotor Impairments from the Acute Time Point to the Subacute Time Point”. For the remaining four sections of the results section of this paper, perform the following: For each significant value reported in the narrative or in associated tables, identify
the statistical test used, the null hypothesis tested, and the conclusion (generalization) of that test. Where applicable, be careful to properly identify the dependent variable used in the hypothesis, and the various independent variables involved in the test.

Note that the correlation coefficient significance level (critical r) is given one time in the narrative so the associated p-value is not reported with each r-value, but only significant r-values are reported. For correlation coefficients generalize about the strength of the relationships.

For this article the linear regression has more than one predictor variable (which was the case in our class example). If a regression equation has more than one predictor variable, then each predictor variable has an associated r-squared value with it. That r-squared value tells you how much of the variance of the outcome variable the one outcome variable accounts for. In this article the results pertaining to regression analysis are explained in the narrative in terms of what % of variance of the outcome variable was explained by a predictor variable. Report these findings as coefficient of determinations (r² values) and the associated p-values of each (which can be figured out from associated tables). Don’t forget to report which hypothesis each of the p-values is associated with.

RELATIONSHIPS BETWEEN IMPAIRMENTS AND REACHING DEFICITS AT THE SUBACUTE TIME POINT.

For each significant value identified in the appropriate table, list the following: Statistical Test Used, hypothesis tested, where appropriate list the outcome variable (dependent variable) and the independent variable (predictor variable), the pertinent statistical values, the interpretation of these values, and the conclusion of the test. (Note: where Spearman Correlation Coefficient were performed r-values >.31 were significant at the p<.05 level). From Table 2, page 759

Statistical Test Used: Spearman’s Correlation Coefficients
Hypothesis tested: Ho: r=0; there is no relationship between C-AROM & Speed:
Value & interpretation: r = .43; there is a fair relationship between C-AROM & Speed
Conclusion: this relationship did not occur due to chance.

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used: Stepwise Multiple Linear Regression
Hypothesis tested: Ho: b=0; there is no predictive relationship between Reaching Speed and C-Str.
Outcome Variable = Reaching Speed
Independent Variable: C-Str
Value(s) & interpretation: \( r^2 = 27\% \text{ (p<.01)} - 27\% \) of the variance in a patient’s subacute Reaching Speed can be explained by the patient’s subacute Composite Strength Score
Conclusion: There is a significant predictive relationship between subacute Reaching Speed and subacute C-Str.

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

RELATIONSHIPS BETWEEN IMPAIRMENTS AT THE ACUTE TIME POINT AND REACHING PERFORMANCE AT THE SUBACUTE TIME POINT

For each significant value identified in the appropriate table, list the following: Statistical Test Used, hypothesis tested, where appropriate list the outcome variable (dependent variable) and the independent variable (predictor variable), the pertinent statistical values, the interpretation of these values, and the conclusion of the test. (Note: where Spearman Correlation Coefficient were performed r-values >.31 were significant at the p<.05 level). From Table 2, page 759

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

DO SENSORIMOTOR IMPAIRMENTS PREDICT GREATER PROPORTIONS OF VARIANCE FOR UE FUNCTION THAN FOR SPECIFIC CHARACTERISTICS OF MOTOR PERFORMANCE?

For each significant value identified in the appropriate table, list the following: Statistical Test Used, hypothesis tested, where appropriate list the outcome variable (dependent variable) and the independent variable (predictor variable), the
pertinent statistical values, the interpretation of these values, and the conclusion of the test. (Note: where Spearman Correlation Coefficient were performed r-values >.31 were significant at the p<.05 level).

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

CONTRIBUTION OF GRIP STRENGTH IMPAIRMENT TO THE VARIANCE IN REACHING PERFORMANCE

For each significant value identified in the appropriate table, list the following:
Statistical Test Used, hypothesis tested, where appropriate list the outcome variable (dependent variable) and the independent variable (predictor variable), the pertinent statistical values, the interpretation of these values, and the conclusion of the test. (Note: where Spearman Correlation Coefficient were performed r-values >.31 were significant at the p<.05 level).

Statistical Test Used: Spearman's Correlation Coefficient
Hypothesis tested: Ho: r=0; there is no relationship between acute Grip Strength and acute C-Str:
Value & interpretation: r = .69; there is a good relationship between acute Grip Strength and acute C-Str
Conclusion: this relationship did not occur due to chance.

Statistical Test Used:
Hypothesis tested:
Value & interpretation:
Conclusion:
Note in the example below, the r-squared value for each independent variable should be reported and the interpretation of this value.

Statistical Test Used: Stepwise Multiple Linear Regression
Hypothesis tested: Ho: b=0; there is no predictive relationship between subacute Reaching Speed and subacute Grip Strength.
Outcome Variable = subacute Reaching Speed
Independent Variable: subacute Grip Strength
Value(s) & interpretation: $r^2 = 33\% (p<\?)$ – 33\% of the variance in a patinet’s Reaching Speed can be explain by the patient’s Grip Strength value
Conclusion: There is a significant predictive relationship between subacute Reaching Speed and subacute Grip Strength.
Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion:

Statistical Test Used:
Hypothesis tested:
Outcome Variable:
Independent Variables:
Value(s) & interpretation:
Conclusion: