Annual Academic Assessment Report Cover Sheet
Assessment reports are due the 1st Wednesday after the Fall Term
Email to: assessment@unlv.edu

Program Information:

<table>
<thead>
<tr>
<th>Program Assessed</th>
<th>Computer Science BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department</td>
<td>Computer Science</td>
</tr>
<tr>
<td>College</td>
<td>Engineering</td>
</tr>
<tr>
<td>Department Chair</td>
<td>Dr. Laxmi Gewali</td>
</tr>
<tr>
<td>Assessment Coordinator</td>
<td>Dr. Laxmi Gewali</td>
</tr>
<tr>
<td>Date Submitted</td>
<td>11/22/2017</td>
</tr>
</tbody>
</table>

Contact Person for This Report

<table>
<thead>
<tr>
<th>Name</th>
<th>Dr. Laxmi Gewali</th>
</tr>
</thead>
<tbody>
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<td>702-895-4028</td>
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<td>Email</td>
<td><a href="mailto:laxmi.gewali@unlv.edu">laxmi.gewali@unlv.edu</a></td>
</tr>
</tbody>
</table>

Please attach a narrative (not to exceed 4 pages, excluding appendices) addressing the following:

- What are the student learning outcomes? Please provide a numbered list.
- Which learning outcomes were assessed?
- How were they assessed? (Programs must use at least one direct assessment of student learning.)
- Undergraduate programs should assess at least one University Undergraduate Learning Outcome (UULO) each year, which may or may not overlap with a program learning outcome.
- Graduate programs should assess at least one outcome related to one of the following graduate level requirements each year:
  - student engagement in research, scholarship, creative expression and/or appropriate high-level professional practice.
  - activities requiring originality, critical analysis and expertise.
  - the development of extensive knowledge in the field under study.
- What was learned from the assessment results?
- How did the program respond to what was learned?

Please limit the narrative portion of your report to no more than four pages. You may attach appendices with data, tables, charts, or other materials as needed. Please explain the relevant conclusions from any appendices in your narrative. Please contact the Office of Academic Assessment if you have questions or need assistance.
Assessment Report
(for NWCCU)

Program: BS in Computer Science

Submitted by
Laxmi Gewali

Department of Computer Science
University of Nevada, Las Vegas

December 2017
I. Introduction

Outcomes Assessed in 2017

In the previous reporting period (2016) Outcomes D, F, G, and H were assessed. In 2017, the following 4 Outcomes (out of the 8 total outcomes) were assessed:

- **Outcome A**: Analyze problems and identify the computing and/or mathematical techniques appropriate to their solutions.
- **Outcome B**: Apply design and development principles in the construction of software systems.
- **Outcome C**: Apply computer science theory and mathematical models to comprehend the tradeoffs involved in various design choices.
- **Outcome D**: Use current tools or techniques to implement and evaluate programs or computer-based systems.

Both **Direct Assessment** and **Indirect Assessment** methods were used to assess the above outcomes.

**Direct Assessment** was done by using either (i) *Selected Question Method*, or (ii) *Model Question Method*. Assessment questions in these methods were prepared by the instructors who taught the courses closely related to the corresponding outcomes. These assessment exams were scheduled at the end of the semester. For either method chosen by the instructor, the answers given by the students were organized in a rubric-categorized table. In this table, performance of student’s answers is grouped into four categories: (i) *Unsatisfactory*, (ii) *Below Expectation*, (iii) *Satisfactory*, and (iv) *Exceeds Expectation*. The tabulated responses are evaluated by the instructor to prepare semester-end assessment pages for each course. Results of the direct assessments for each outcome are summarized in a table. A threshold of 70% of students scoring satisfactory or more was set by the Assessment Committee as successful achievement of the outcome.

**Indirect Assessment** was done by using the following two instruments:

- Semester-end evaluations of outcomes by students taking the course. The responses were grouped into four categories: (i) Excellent, (ii) Good, (iii) Neutral, (iv) Fair, and (v) Poor. A median score of Good or better is considered achieving satisfactory outcome.
- Exit Interviews. Each graduating student in their 4th year is given a questionnaire to collect their input regarding the level of achievement in each of eight student learning outcomes.
II. Assessment Results

Direct Assessment of Outcome A

Courses used to cover Outcome A:

- CS 135 (1,2,3,10,13): Computer Science I
- CS 456 (1): Automata and Formal Languages

Direct Assessment examinations were given by instructors of CS 135 and 456 to cover Outcome A on the final week of the semester. Tabulated results of direct assessment (Percentage Distribution) are as shown in the following table:

<table>
<thead>
<tr>
<th>Outcome A</th>
<th>Unsatisfactory (U)</th>
<th>Below Expectation (BE)</th>
<th>Satisfactory (S)</th>
<th>Exceeds Expectation (EE)</th>
<th>Remark for S+EE (Is it &gt;= 70% Threshold?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2017</td>
<td>3.40</td>
<td>11.17</td>
<td>45.63</td>
<td>39.81</td>
<td>85.44 &gt;= 70%</td>
</tr>
</tbody>
</table>

- Overall Results for Outcome A: In Spring, the targeted threshold of 70% was achieved by a healthy margin.

Notable suggested improvement(s) by instructor(s) and Assessment Committee:

- **Enforcing Prerequisite**: The Assessment Committee had previously recommended the need to close the loopholes in prerequisite enforcement to weed out students without the correct background. Almost no students did not fulfill prerequisites. Significant progress has been made.

Direct Assessment of Outcome B:

Courses used to cover Outcome F:

- CS 135 (1,2,3,10): Computer Science I
- CS 202 (1,2,3,4): Computer Science II
- CS 460 (1): Compiler Construction
- CS 472 (1): Software Product Design and Development I

Direct Assessment examinations were given by instructors of CS 135,202, 460 and 472 to cover Outcome B on the final week of the semester. Tabulated results of direct assessment (Percentage Distribution) are as shown in the following table:
Overall Results for Outcome B: In Spring 2017, the targeted threshold of 70% was not achieved.

Notable suggested improvement(s) by instructor(s) and Assessment Committee.

- **Early Intervention:** Early intervention efforts were increased in Spring 2017. As part of a College of Engineering (CoE) wide effort, the Department of Computer Science in coordination with the CoE Academic Advising has performed extensive early intervention activities. Approximately 65 students (~10%) across 100 and 200 level course (135, 202, and 218) were identified for early intervention. The intervention included working with the instructor and academic advising staff to identify issues, apply tutoring, and/or make schedule adjustments as appropriate. The long-term results are being tracked by the CoE Academic Advising and will be reported next calendar year. It is recommended to continue the early intervention activities. It is further recommended that when the long term results are available, further analysis be performed for possible improvements. These efforts are in line with UNLV’s Campus Connect program.

- **Monitoring of Enrollment:** It should be noted that the low achievement for outcome B (which pertains to early courses) may be due to the large increase in enrollment and the increased number of transfer students. Stricter checking of prerequisites and remediation should be considered.

- **Consistency of Assessment across Sections:** The department should explore how to further coordinate assessment tests across sections, especially for CS 202.

### Direct Assessment of Outcome C:

Courses used to cover Outcome C:
- CS 302: Data Structures
- CS 477: Analysis of Algorithms

Direct Assessment examinations were given by instructors of CS 302 and 477 to cover Outcome C on the final week of the semester. Tabulated results of direct assessment (Percentage Distribution) are as shown in the following table:

<table>
<thead>
<tr>
<th></th>
<th>Unsatisfactory (U)</th>
<th>Below Expectation (BE)</th>
<th>Satisfactory (S)</th>
<th>Exceeds Expectation (EE)</th>
<th>Remark for S+EE (Is it &gt;= 70% Threshold?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2017</td>
<td>6.83</td>
<td>30.03</td>
<td>40.61</td>
<td>22.53</td>
<td>63.14 &lt; 70</td>
</tr>
</tbody>
</table>
• **Overall Results for Outcome C**: In Spring 2017 the targeted threshold of 70% was fully achieved.

**Notable suggested improvement(s) by instructor(s) and Assessment Committee.**

• **Course Shadowing**: As preparation for teaching new course sections, instructors are encouraged to connect with colleagues (usually in the prior semester) who have already taught such sections. Emphasis is on Outcome Assessment.

**Direct Assessment of Outcome D:**

Courses used to cover Outcome D:

- CS 135 (3): Computer Science I
- CS 218 (1,2): Introduction to Systems Programming
- CS 219 (1,2): Computer Organization
- CS 326 (1): Programming Languages, Concepts and Implementation
- CS 370 (1,2): Operating Systems
- CS 472 (1): Software Product Design and Development I

Direct Assessment examinations were given by instructors of CS 135, 218, 219, 326, 370, 472 to cover Outcome D on the final week of the semester. Tabulated results of direct assessment (Percentage Distribution) are as shown in the following table:

<table>
<thead>
<tr>
<th>Outcome D</th>
<th>Unsatisfactory (U)</th>
<th>Below Expectation (BE)</th>
<th>Satisfactory (S)</th>
<th>Exceeds Expectation (EE)</th>
<th>Remark for S+EE (Is it &gt;= 70% Threshold?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2017</td>
<td>8.27</td>
<td>20.87</td>
<td>48.03</td>
<td>22.83</td>
<td>70.86 &gt;= 70</td>
</tr>
</tbody>
</table>

• **Overall Results for Outcome D**: Outcome for outcome D were achieved.

**Notable suggested improvement(s) by instructor(s) and Assessment Committee**

• **Lab Monitors**: In Spring 2017 the level of lab monitors was kept at the increased level from the previous semester (5 lab monitors with hours in the range 10 to 20 per week).
Effectiveness of Lab Monitors: Since Student Evaluations were made online there is no obvious way to attach questionnaires regarding lab monitors. The department is working on a module to add online questionnaires to CS online classes.

Indirect Assessment for Outcomes A, B, C, and D

Courses evaluated by students for
- Outcome A: CS 135 (1,2,3,10,13), CS 456 (1)
- Outcome B: CS 202 (1,2,3,4), CS 460 (1), CS 472 (1).
- Outcome C: CS 302 (1, 2, 3), CS 477 (1)
- Outcome D: CS 135 (3), CS 218 (1,2), CS 219 (1,2), CS 326 (1), CS 370 (1,2), CS 472 (1)

Questionnaires for evaluating outcomes covered by the courses were distributed in the class at the end of the semester by an administrative member arranged by Dean Office / CS Office. Responses to these questions were collected and analyzed to access the outcomes. Outcome wise results are as follows.

<table>
<thead>
<tr>
<th>Indirect Assessment Method Results (Spring 2017)</th>
<th>Semester End Course/Instructor Evaluation by Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achievement Level</td>
<td>(E – Excellent, G – Good, N – Neutral, F – Fair, P – Poor, N/A – Not Available)</td>
</tr>
<tr>
<td>Outcome</td>
<td>E</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>A</td>
<td>54.46</td>
</tr>
<tr>
<td>B</td>
<td>77.07</td>
</tr>
<tr>
<td>C</td>
<td>56.98</td>
</tr>
<tr>
<td>D</td>
<td>55.03</td>
</tr>
</tbody>
</table>

Conclusion: For the above 4 outcomes, measured indirectly, the median achievement level is good (G) or better. This means achievement levels for Outcomes A, B, C, and D, as measured indirectly, is satisfactory.

Exit Interviews

Each graduating student in their 4th year is given a questionnaire to collect their input regarding the level of achievement in each of eight student learning outcomes. Responses to the outcomes are collected in four categories (Very well, pretty well, somewhat, not at all). In addition, comments can be provided.

Summary results from responses for outcomes A, B, C and D are as follows:
Summary Results of Senior Exit Interview Outcomes A, B, C and D (Spring 2017)

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>very well</th>
<th>petty well</th>
<th>somewhat</th>
<th>Not at all</th>
<th>% of students rating at least “pretty well”</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>91.67</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>83.33</td>
</tr>
<tr>
<td>C</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>83.33</td>
</tr>
<tr>
<td>D</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>91.67</td>
</tr>
</tbody>
</table>

Comments from students on the exit interview: It was mentioned that there should be more electives each semester in order to give students flexible options. We have taken the recommendation of the students to heart and we have responded by numerous measures, including offering:

1. CS 489 Big Data (Dr. Zhan)
2. CS 489 Cloud Computing (Dr. Zhan)
3. CS 420 Human Computer Interaction (Dr. Nazos)
4. CS 490: Green Computing (Dr. Bein)
5. CS 443 Information Assurance (Dr. Jo)
6. CS 445 Internet Security (Dr. Kim)
7. UNLV’s Hackathon (embedded in CS 445).

For Fall 2017 there is a significant increase in enrollment for CS 420 and CS 443, and students are getting the benefit of increased capacity in application area courses with up to 50 students per course, while at the same time not overloading the courses beyond 50.

Assessment Result for University Undergraduate Learning Objectives (UULO’s)

A number of course in the BS program (CS 135, 218, 219, 326, 370, 472) are related to outcome D, namely to use current tools or techniques to implement and evaluate programs or computer-based systems. Outcome D thus overlaps with UULO’s intellectual breadth and lifelong learning objectives. Furthermore, outcome C (“apply computer science theory and mathematical models to comprehend the tradeoffs involved in various design choices”) relates to the transfer knowledge and skills gained from general and specialized studies to new settings and complex problems. Both direct and indirect assessment, as well as exit interviews, indicate that students
achieved these goals. Outcomes A (“analyze problems and identify the computing and/or mathematical techniques appropriate to their solutions”) is related to UULO’s Inquiry and Critical Thinking goal; outcome A is present both in the early course CS 135, as well as in the advanced CS 456. Assessment data shows that students achieved this goal at a high level.

III. Plan for Next Assessment Period
(Spring 2018)

- Repeat assessment of Outcomes D, F, G, H, previously done in 2016, by using both direct and indirect methods.
- Analyze assessed data to obtain key findings.
- Follow-up on the suggestions for improving outcomes as recommended in this assessment period.