Assessment Report
For
Department of Mathematics & Statistics
(Academic Unit Name)

2014-15 Academic Year
December 19, 2014
(Assessment Period Covered)
(Date Submitted)

Includes Assessment Reports for the Instructional Programs listed below:

Title of Degree Program                  Degree Level
Bachelor of Science in Applied Mathematics (Option Applied Mathematics)  Bachelor
Assessment Report
For
Bachelor of Science in Applied Mathematics
(Instructional Degree Program)
Bachelor
(Degree Level)
Academic Year 2014-15
(Assessment Period Covered)
December 19, 2014
(Date Submitted)

NOTE: There should be one form B for each degree program offered by your department.

Expected Outcomes of this Degree Program:
When they complete this degree program, students will be able to . . .

1. Probability and Stochastic Processes

When they complete this degree program, students will be able to demonstrate to have acquired the understanding of the concepts in Probability and Stochastic Processes, in topics including, basic concepts, conditional probability, discrete distributions, continuous distributions, and joint distributions.

If you wish to record additional expected outcomes, simply cut and paste one of the boxes above.
Assessment Report
For

Bachelor of Science in Applied Mathematics
(Option Applied Mathematics)
(Instructional Degree Program)

Academic Year 2014-15
(Assessment Period Covered)

Bachelor
(Degree Level)

December 19, 2014
(Date Submitted)

NOTE: There should be at least one form C for each expected outcome listed on form B. If you used more than one assessment method to gather information about an expected outcome, there should be one form C for each assessment method. Thus, if you studied three outcomes during the year and used two means of assessment to gather information about each outcome, you would provide a total of six different copies of form C.

Expected Outcome Brief Description:
Students will demonstrate an understanding of concepts in the course on “Probability and Stochastic Processes”, in topics including, basic concepts in probability and stochastic processes, conditional probability, discrete distributions, continuous distributions, and joint distributions.

Assessment Method, Brief Description:
Common Examination on Items

Assessment Method, Full Description:
The Chair of the department Dr. T.Y. Tam set up an Assessment Committee of the department for the purpose of assessing the programs, comprising of the faculty N.K. Govil (Chair), Ziqin Feng (Co-chair), Dmitry Glotov (Member), Erkan Nane (Member) and Jessica McDonald (Member). This committee then identified some concepts in the course on “Probability and Stochastic Processes” that the committee thought every undergraduate student majoring in Applied Mathematics (Option Applied Mathematics) must know before graduation. Also, this committee helped in making a test having minimum of two questions on each of these concepts, which was then used to find learning outcomes to test the understanding of different concepts in Probability and Stochastic Processes, that have been identified by the committee.

The students were given this test towards the end of Fall Semester 2014 in the course on “Probability and Stochastic Processes” and the data concerning the performance in these tests was collected and analyzed. The total number of students who took this test for learning outcome “Understanding of Concepts in Probability and Stochastic Processes” was 6, and every undergraduate student majoring in Applied Mathematics (Option Applied Mathematics) is required to take this test at some stage because the course where these concepts are covered is a required course for graduation. A copy of the Test is appended at the end of this form, as Appendix 1.

The data, along with its analysis, concerning the performance in this test is given in the next section, which is on “Assessment Method, Findings”.

Assessment Method, Findings:
In the table given below, the data (and its analysis) is obtained on the basis of test given to students. Test items, 1 and 2, are on the concept, Basic Concepts in Probability and Stochastic Processes; test items, 3 and 4, are on the concept, Conditional Probability, and so on. The average proportion of students answering test items 1 and 2 correctly is 67%. See the Appendix 2 for more detailed findings of the assessment.

<table>
<thead>
<tr>
<th>Topics</th>
<th>Test Items Addressing This Learning Goal</th>
<th>Average Proportion of Students Answering These Questions Correctly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Concepts</td>
<td>1 and 2</td>
<td>25%</td>
</tr>
<tr>
<td>Conditional Probability</td>
<td>3 and 4</td>
<td>42%</td>
</tr>
<tr>
<td>Discrete Distributions</td>
<td>5 and 6</td>
<td>83%</td>
</tr>
<tr>
<td>Continuous Distributions</td>
<td>7 and 8</td>
<td>67%</td>
</tr>
<tr>
<td>Joint Distributions</td>
<td>9 and 10</td>
<td>58%</td>
</tr>
</tbody>
</table>

Based on the table given above we find that the students appear to be strong in “Continuous Distributions”, and “Discrete Distributions”, not so strong in while only acceptable in “Conditional Probability” and “Joint Distributions”, while weak in “Basic Concepts”.

**Assessment Method, Use of Findings for Improvement:**

The findings obtained and mentioned in the above section on “Assessment Method, Findings” were discussed with the members of the committee and agreed upon that the instructors teaching these concepts in future will be told of these finding and advised to take measures for correcting this by

(i) Spending more time on the topic “Joint Distributions” where students appear to be weak.
(ii) Provide longer office hours, and encourage students to seek help during the office hours.

Also, the committee will place a request to the department chair to provide some Graduate Teaching Assistants who could provide extra help to students in particular to the topics “Basic Concepts”, and “Conditional Probability”, “Joint Distributions”, where the students are not so strong or weak.

**Any Additional Comments?**

---

**Appendix 1. Test used for the Assessment:**

Appended below is the copy of the test prepared with the help of the Department Assessment Committee, and used for the purpose of assessment.

I. Basic Concepts
1. Two events \( A \) and \( B \) in a sample space are mutually exclusive means that \( P(A \cup B) = P(A) + P(B) \).

   True    False

2. Any probability function \( P:S \to [0,1] \) satisfies \( P(A \cup B) = P(A) + P(B) \) for any two events \( A \) and \( B \).

   True    False

II. Conditional Probability

3. Conditional probability is a probability if the given is fixed.

   True    False

4. If two events \( A \) and \( B \) are independent then \( P(A \cup B) = P(A) + P(B) \).

   True    False

III. Discrete Distributions

5. Mean value of a random variable is a measure of center of the values

   True    False

6. Binomial\((n,p)\) mass values converge to Poisson \((\lambda)\) mass values for \( \lambda = np \) as \( n \) gets large.

   True    False

IV. Continuous Distributions

7. 100th percentile, \( \pi_p \), of a continuous random variable with cumulative distribution \( F \) can be obtained by solving the equation \( F(\pi_p) = p \).

   True    False

8. Exponential random variable is a special Beta random variable.

   True    False

V. Joint Distributions

9. If the joint density of the random vector \((X,Y)\) is given as a product of the marginal probability density functions, then \( X \) and \( Y \) are independent.

   True    False

10. Sum of two exponential random variables is exponential.

   True    False

Appendix 2. Table with Detailed Data:

Given below is the table consisting of the data (and its analysis) collected on the basis of scores obtained by the students in the test. In this table, s1, s2, s3, … refer to Student # 1, Student # 2, Student # 3, and so on. For example Student #1 obtained a score of 1 on Question # 1, score of 1 on Question # 2, a score of 1 on Question # 3, and so on. Looking at the first two rows (covered in yellow) of the table we find that all the students obtained an average of 67% on the concept of “Basic Concepts” (covered by Questions 1 and 2), an average of 67% on the concepts of “Conditional Probability” (covered by Questions 3 and 4), an average of 75% on the concepts of “Discrete Distributions” (covered by Questions 5 and 6), 89% on the concepts of “Continuous Distributions” (covered by Questions 7 and 8), and 61% on the concepts of “Joint Distributions” (Covered by Question 9 and 10). This data has been summarized in the Table given above in the Section on “Assessment Method, Findings”. 
<table>
<thead>
<tr>
<th>Questions</th>
<th>s1</th>
<th>s2</th>
<th>s3</th>
<th>s4</th>
<th>s5</th>
<th>s6</th>
<th>Basic Concepts</th>
<th>25%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Basic Concepts</td>
<td>25%</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>Basic Concepts</td>
<td>25%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>Conditional Probability</td>
<td>42%</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Conditional Probability</td>
<td>42%</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Discrete Distributions</td>
<td>83%</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Discrete Distributions</td>
<td>83%</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Continuous Distributions</td>
<td>67%</td>
</tr>
<tr>
<td>8</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>Continuous Distributions</td>
<td>67%</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>Joint Distributions</td>
<td>58%</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>Joint Distributions</td>
<td>58%</td>
</tr>
</tbody>
</table>