Open Education Resource:
Probability Theory and Random Variables

Work done as part of AICTE approved FDP on Use of ICT in Education for Online and Blended Learning

**RC 1080_029**

D.L.Chaitanya  
Dr. N. Swetha  
HimaBindu Valiveti

OER Submission by RC 1080_018, GRIET, Hyderabad is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. You are free to use, distribute and modify it, including for commercial purposes, provided you acknowledge the source and share-alike. *This template belongs to OER Submission Example by IDP in Educational Technology, IIT Bombay

To view a copy of this license, visit [http://creativecommons.org/licenses/by-sa/4.0/](http://creativecommons.org/licenses/by-sa/4.0/)
Contents

Contents.................................................................................................................................................. 2

Open Educational Resource: Probability and Random Variables .......................................................... 3
  About OER.......................................................................................................................................... 3
  Learning Objectives .................................................................................................................. 4
  Helpful Documentation for Tool Use...................................................................................................... 4

Section 2: Design Decisions .................................................................................................................. 5
  How to use this OER For using this OER, .............................................................................................. 15
  Best Practices with Lesson Activity........................................................................................................ 15

Section 4: Evaluating Effectiveness of OER.......................................................................................... 16
  Effectiveness at the student level ........................................................................................................... 16
  Effectiveness at consumer level ............................................................................................................. 16
  Implementing Survey............................................................................................................................... 16
  Survey Questions.................................................................................................................................. 17

Section 5: Consolidated Log of Team Work.......................................................................................... 18

Section 6: Building a Community of Power System Analysis Users ..................................................... 19
  Possible Sources for Community Building ............................................................................................ 19
  Plans for Community Building............................................................................................................. 19

Works Cited............................................................................................................................................ 20
Open Educational Resource: Probability and Random Variables

About OER

A random variable is a function that maps the outcomes of unpredictable procedures to numerical quantities like real numbers. The underlying process providing the input to this procedure yields random output that the procedure maps to a real-numbered value.

A random variable’s possible values might represent the possible outcomes of a yet-to-be-performed experiment, or the possible outcomes of a past experiment whose already-existing value is uncertain due to imprecise measurements or uncertainty.

A random variable has a probability distribution, which specifies the probability that its value falls in any given interval.

This Open Education Resource on Probability and Random variables is useful for the undergraduate students to understand the Stochastic processes.

- Download Link:

- Target Audience: B. Tech II year I semester ECE undergraduate Students

- Tags: Random variable, axioms, properties of random variables, Bayes theorem, MAP receiver, Flipped classroom, MOODLE activities, Engineering students.

- OER developed using licensed Microsoft office and evaluation version of screencast-o-matic.

- OER Submission by RC 1080_018, GRIET, Hyderabad is licensed under the Creative Commons Attribution-ShareAlike 4.0 International License. To view a copy of this license, visit
  http://creativecommons.org/licenses/by-sa/4.0/
Learning Objectives

After using OER the learner will be able to

• Understand and apply axioms of probability.
• Define a random variable and its properties.
• Learn the Bayes theorem and its applications.

Helpful Documentation for Tool Use

[1] for design and development of Lesson Activity in MOODLE (an Open Source Tool)
[2] for use of Screencast-O-Matic
[3] for use of Wordpress.com
Section 2: Design Decisions

Nature of Decisions taken

The design decisions involved in the creation of this OER were of broadly three types:

1. Content Decisions
2. Pedagogic Decisions
3. Technology Decisions
4. Assessment Decisions

Content Decisions

The content decisions related to:

a. Topics to be covered in detail – Decided on random variables, axioms of probability, basics of total probability theorem to solve the problems.

b. Lessons in the form of PPTs and Videos are provided in the website

Typically in a flipped classroom strategy, there are two segments – Out-of-class segment and In-Class segment. The out-of-class segment requires student to refer to some given material (Video, PPTs etc) and form an understanding about the concepts that are relevant. In terms of concept marking the pedagogic decisions that were taken for the Out-of-class segment related to:

a. Cognitive Levels of Questions to be asked along with the resources – Mostly Recall to apply level question for out of class and Create Level question for In-class

b. Assessment Strategies – Multiple choice questions for out of class, Team-Pair-Solo strategy for in-class

Technology Decisions

While developing the Out-of-Class and In-class activities, the major technology decisions taken were:

a. Tool to be used for creating screencast – Jing, as it had a time limit of 5 minutes and provided option for creating videos as .swf files that can be directly played from browser.

b. MOODLE Lesson Activity for setting up Out-of-Class segment as it allowed guided self learning.

Open Education Resource: Probability and Random Variables
Section 3: OER Description

Active OER For checking the active OER, you may access the Course – “OER: Power System Analysis” at:


Lesson Settings

Screenshots 1-3 shows the general settings of a Lesson in word press. This is same for all the lessons. If there are variations, then they are duly noted under each description.

Screenshot 1: General appearance of OER in wordpress.com

Screenshot 2: General appearance of OER Lessons in wordpress.com

Open Education Resource: Probability and Random Variables
Screenshot 3: General appearance of OER Lecture Video links in wordpress.com

Screenshot 5: General appearance of OER Lesson Video in You tube

Open Education Resource: Probability and Random Variables
Screenshot 6: General appearance of OER Lesson PPTs and Flipped Classroom Activity links in wordpress.com

Screenshot 7: Creating the Course in MOODLE

Open Education Resource: Probability and Random Variables
Screenshot 8: Creation of Adding a New Quiz in Moodle

Adding a new Quiz to 7 June - 13 June

General
Name: Basics of Probability
Description: All questions are mandatory. All the questions carry equal marks.
Display description on course page: off

Screenshot 9: Time Settings for Quiz in Moodle

Timing
Open the quiz: 5 June 2018 14:00
Close the quiz: 5 June 2018 14:10
Time limit: 0 minutes
When time expires: Open attempts are submitted automatically
Submission grace period: 0 minutes

Open Education Resource: Probability and Random Variables
Screenshot 10: Sample Multiple Choice Questions for Quiz in Moodle

Open Education Resource: Probability and Random Variables
Screenshot 11: Appearance of Multiple Choice Questions for Quiz in Moodle

- **Question 1:** Method in which previously calculated probabilities are revised with new probabilities is classified as
  - A. updating theorem
  - B. revised theorem
  - C. Bayes's theorem
  - D. dependency theorem

- **Question 2:** If the number of outcomes in collection are 2 and the distinct outcomes are 4 then the count value according to permutations is
  - A. 2
  - B. 12
  - C. 24
  - D. 4

Screenshot 12: Editing Quiz in Moodle

Open Education Resource: Probability and Random Variables
Screenshot 13: Appearance of Quiz Results in Moodle

**Quiz-1**

Answer all the Questions. All questions carry equal marks.

Attempts allowed: 1

The quiz will not be available until Sunday, 10 June 2018, 2:00 PM
This quiz will close at Sunday, 10 June 2018, 2:10 PM
To attempt this quiz you need to know the quiz password

**Summary of your previous attempts**

<table>
<thead>
<tr>
<th>State</th>
<th>Grade / 10.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finished Submitted Sunday, 10 June 2018, 1:43 PM</td>
<td>8.00</td>
</tr>
</tbody>
</table>

Your final grade for this quiz is 8.00/10.00.

[Back to the course]

Screenshot 14: Appearance of Discussion Forum in Moodle

Announcements

General news and announcements

[Add a new topic]

<table>
<thead>
<tr>
<th>Discussion</th>
<th>Started by</th>
<th>Replies</th>
<th>Last post</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion Forum</td>
<td>HimaBindu Valiveti</td>
<td>0</td>
<td>HimaBindu Valiveti</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sun, 10 Jun 2018, 1:51 PM</td>
</tr>
</tbody>
</table>

User blog: HimaBindu Valiveti

[Add a new entry]

**Basics of Probability**

by HimaBindu Valiveti - Sunday, 10 June 2018, 1:49 PM

I hope all of you went through the videos and the presentations uploaded.
The flipped classroom activity has also been uploaded for your perusal. Please post your queries here or in the forum.

[Edit | Delete | Permalink | Comments (0)]

Open Education Resource: Probability and Random Variables
Screenshot 15: Sample Learning objectives for this OER

Introduction to Probability Theory

Outline
- Basic concepts in probability theory
- Axioms of Probability

Screenshot 16: Sample Alignment of Assessment with Learning objectives for this OER

Assessment strategies

- Internal marks: 20
- Assignment marks: 5
- Class tests: 5
- External marks: 70

Open Education Resource: Probability and Random Variables
Screenshot 17: Active learning strategy for this OER

Active Learning strategies

1. Active learning activity
   1. Peer instruction
   2. Team-pair-solo
   3. Think-pair-share

Explain the strategy by giving details of:
1. What Teacher will do?
2. What students will do?

Justify why the above is an active learning strategy:
1. Enter justification here.
How to use this OER

For using this OER,

- please visit https://himabinduvaliveti.wordpress.com/2018/06/09/oer-probability-and-random-variables/

To view Lesson Videos make sure that you have high speed connectivity.

Step 1: Download the set of 6 lessons PPTs from the site.

Step 2: Watch the out of class lesson videos through the links provided in the site before attending the class.

Step 3: Follow the TPS activity provided in the Flipped Classroom activity PPT for higher level learning in In Class Activity.

Step 4: Attempt the quiz provided in Flipped Classroom activity PPT for assessment.

Step 5: Follow the same procedure for the remaining classes.

Best Practices with Lesson Activity

Here are some of the best practices on using this Lesson Activity in classroom:

1. Provide this activity at least 1 week in advance.

2. Provide incentive for students who have completed out of the class activity (i.e., Watching Videos and attempting quiz, etc.).


4. Provide additional open source tools like scilab to solve nonlinear algebraic equation problems.

Open Education Resource: Probability and Random Variables
Section 4: Evaluating Effectiveness of OER

The OER effectiveness can be assessed at two levels:

1. At the student level
2. At the consumer level

Effectiveness at the student level
Effectiveness at the student level involves metrics related to student access of the resource and student learning. The assessment through the quiz provided in the OER can be used to evaluate this effectiveness, with the report showing the total number of students who accessed the reports (along with time) and their marks (based on their answers to MCQs). Additionally there is an option for teacher to grade essays and these marks also will be calculated if needed.

Effectiveness at consumer level
OER consumers are typically teachers who want their students to learn Power System Analysis. Linking a survey on three main constructs – Ease of Use, Concept Coverage and Concept Complexity, can help in identifying the effectiveness of this OER at consumer level. This has to be done as a follow-up activity.

Implementing Survey
Thus every user who downloads this resource will be asked their email address and as a follow up the survey will be send to their email address.
## Survey Questions

<table>
<thead>
<tr>
<th>Type</th>
<th>Questions</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy</td>
<td>I found it easy to download the Lesson Activity</td>
<td>Strongly Disagree to Strongly Agree (1 to 5 point)</td>
</tr>
<tr>
<td></td>
<td>I found the instructions to setup the Lesson Activity useful in setting the activity in my Course</td>
<td></td>
</tr>
<tr>
<td></td>
<td>I was able to successfully create Lesson in my own course</td>
<td></td>
</tr>
<tr>
<td>Concept coverage</td>
<td>The Lesson covers the required concepts related to concept maps that I need for my course</td>
<td></td>
</tr>
<tr>
<td>Concept Complexity</td>
<td>The content inside the Lesson is too complex for my students to understand</td>
<td></td>
</tr>
</tbody>
</table>
## Section 5: Consolidated Log of Team Work

The consolidated log of team work is as shown below:

<table>
<thead>
<tr>
<th>Activity</th>
<th>Team Member</th>
<th>Amount of Time</th>
<th>Additional Logs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td>Team Leader</td>
<td>3 hours</td>
<td>Deliberated on topics, courses, quizzes, active learning activities</td>
</tr>
<tr>
<td></td>
<td>Team Leader 1</td>
<td>3 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Leader 2</td>
<td>3 hours</td>
<td></td>
</tr>
<tr>
<td>Tool Exploration</td>
<td>Team Leader</td>
<td>4 hours</td>
<td>Explored Moodle, Wordpress, Screecast-o-matic, MS office</td>
</tr>
<tr>
<td></td>
<td>Team Leader 1</td>
<td>4 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Leader 2</td>
<td>4 hours</td>
<td></td>
</tr>
<tr>
<td>OER Creation</td>
<td>Team Leader</td>
<td>10 hours</td>
<td>Flipped classes activity design, creation of videos and ppts, wordpress webpage activity</td>
</tr>
<tr>
<td></td>
<td>Team Leader 1</td>
<td>10 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Leader 2</td>
<td>10 hours</td>
<td></td>
</tr>
<tr>
<td>OER Documentation</td>
<td>Team Leader</td>
<td>3 hours</td>
<td>Description of OER, Screen shots of OER creation, How to use of OER, Evaluation</td>
</tr>
<tr>
<td></td>
<td>Team Leader 1</td>
<td>3 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Leader 2</td>
<td>3 hours</td>
<td></td>
</tr>
<tr>
<td>Individual Reflection</td>
<td>Team Leader</td>
<td>10 hours</td>
<td>Material preparation</td>
</tr>
<tr>
<td>(Diary Logging)</td>
<td>Team Leader 1</td>
<td>10 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Leader 2</td>
<td>10 hours</td>
<td></td>
</tr>
<tr>
<td>OER Evaluation</td>
<td>Team Leader</td>
<td>2 hours</td>
<td>Rubric verification</td>
</tr>
<tr>
<td></td>
<td>Team Leader 1</td>
<td>2 hours</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Team Leader 2</td>
<td>2 hours</td>
<td></td>
</tr>
</tbody>
</table>

Team No. RC1080_029

Team Leader: **D.L. Chaitanya**

Team Member 1: **Dr. N. Swetha**

Team Member 2: **HimaBindu Valiveti**

Open Education Resource: Probability and Random Variables
Section 6: Building a Community of Power System Analysis Users

Possible Sources for Community Building

Some of the viable sources for building a community are:

- Teachers who are teaching Power System Analysis
- Teachers who plan to use Flipped Classroom Strategies

Plans for Community Building

The resource is already available at https://himabinduvaliveti.wordpress.com/2018/06/09/oer-probability-and-random-variables/ and its access is open to the users and queries can be posted through contact page or using email ID provided. Thus there will be a list of interested users whom we can follow up using email. All the interested users can then be connected using a local Wordpress.
Works Cited


http://help.screencast-o-matic.com/