

<b>Instructor</b>	Dola Pathak <a href="mailto:dpathak@msu.edu">dpathak@msu.edu</a> Office hours (via zoom <a href="https://msu.zoom.us/j/93007006215">https://msu.zoom.us/j/93007006215</a> Password: <b>STT180DOLA</b> ) MW 3:00 -- 4:00pm (Other times by appointment).
<b>Teaching Assistant</b>	Sikta Dasadhikari <a href="mailto:dasadhik@msu.edu">dasadhik@msu.edu</a> Office Hour: TBA via zoom <a href="https://msu.zoom.us/j/98550135737">https://msu.zoom.us/j/98550135737</a> & Password: <b>STT180HELP</b>
<b>Learning Assistants</b>	Andrew Wilt ( <a href="mailto:wiltand1@msu.edu">wiltand1@msu.edu</a> ) Jordan Polk ( <a href="mailto:polkjord@msu.edu">polkjord@msu.edu</a> ) Helproom Hours: TBA via zoom <a href="https://msu.zoom.us/j/98550135737">https://msu.zoom.us/j/98550135737</a> & Password: <b>STT180HELP</b>
<b>Course Meetings</b>	Mondays and Wednesdays 10:20 AM-12:10 PM via Zoom <a href="https://msu.zoom.us/j/97604487557">https://msu.zoom.us/j/97604487557</a> Password: <b>CLASSROOM1</b> <i>Two meetings per week, on MW are synchronous during the scheduled class time in Michigan (US Eastern Time Zone). Accommodations will be made for students who cannot attend synchronously because <b>of time zone</b> issues. Contact your <b>instructor immediately</b> if that is the case for you.</i>
<b>Course Description</b>	Pervasiveness and utility of data in modern society. Obtaining and managing data. Summarizing and visualizing data. Ethical issues in data science. Communication with data. Fundamentals of probability and statistics.
<b>Course Mission</b>	Step into the world of Data Science using R: This course will introduce you to the world of analytics using exploratory and statistical methods and help you to reason, critically think, analyze, interpret, and present information extracted from data!
<b>Course Objectives</b>	In this course you will learn about data ethics, how to manipulate data objects, produce advanced graphics, tidy and wrangle data, generate reproducible statistical reports using R markdown, learn about the fundamentals of probability and statistics, and rudimentary machine learning techniques.
<b>Course platform and management</b>	This course will be delivered online through <b>D2L</b> . You will need your MSU NetID to login to the course from the D2L homepage ( <a href="http://d2l.msu.edu">http://d2l.msu.edu</a> ).

In D2L, you will access the slides and videos, course materials, and additional resources. For instant communication and group works, this course will use **MS Teams**. The link to download MS Teams for mobile and desktop can be found in <https://www.microsoft.com/en-us/microsoft-365/microsoft-teams/download-app>

<b>Prerequisites</b>	A course in calculus (either MTH 124, MTH 132, MTH 152H, or LB 118) is required (can be taken concurrently)
<b>Course structure and assessment components.</b>	Please refer to the supplemental file in the "Getting started and navigating the course" folder.
<b>Required Texts</b>	<ul style="list-style-type: none"> <li>• <b>R Programming for Data Sciences by Melfi, Finley, and Doser</b> (pdf in D2L (<a href="https://www.stt.msu.edu/~melfi/STT180Text">https://www.stt.msu.edu/~melfi/STT180Text</a>))</li> <li>• <b>Naked Statistics: Stripping the Dread from the Data by Charles Wheelan</b> (available in the bookstore and at <a href="https://www.amazon.com/Naked-Statistics-Stripping-Dread-Data-ebook/dp/B007Q6XLF2">https://www.amazon.com/Naked-Statistics-Stripping-Dread-Data-ebook/dp/B007Q6XLF2</a>).</li> <li>• <b>OpenIntro</b> (pdf in D2L).</li> </ul>
<b>Supplemental Texts</b>	<p>R for Data Science (<a href="https://r4ds.had.co.nz/index.html">https://r4ds.had.co.nz/index.html</a>)</p> <p>R Cookbook (<a href="https://rc2e.com">https://rc2e.com</a>)</p> <p>Both are available in the library, online, and as inexpensive printed versions from Amazon. Neither is required</p>
<b>Required Technologies</b>	D2L, R, RStudio, and Teams. Please have R/RStudio and Teams installed before the class starts. Instructions to install R/Rstudio is course content "Getting Started" folder. Please check availability in your current location.
<b>Technology Help</b>	Help with D2L: <a href="https://help.d2l.msu.edu">https://help.d2l.msu.edu</a>
<b>Internet and Connectivity</b>	<p>The course requires access to "high speed" internet. Since the class is synchronous, and class work, exams will be done synchronously, it is very important to have reliable internet and webcam access.</p> <p>If ever, students have accessibility issues during synchronous class or exam sessions, they should immediately inform the instructional team and provide proof of the issue.</p>
<b>Grading</b>	<p>Participation, 20%</p> <p>Exams (3 in total), 30%</p> <p>Homework, 20%</p> <p>Project, 30%</p>

**Grade Cutoffs** Let  $X$  be a student's final grade computed as a percentage. A student's final grade on the 4.0 scale will be determined as follows:

<b>4.0</b>	<b><math>90 \leq X \leq 100</math></b>	<b>2.0</b>	<b><math>70 \leq X &lt; 75</math></b>
<b>3.5</b>	<b><math>85 \leq X &lt; 90</math></b>	<b>1.5</b>	<b><math>65 \leq X &lt; 70</math></b>
<b>3.0</b>	<b><math>80 \leq X &lt; 85</math></b>	<b>1.0</b>	<b><math>60 \leq X &lt; 65</math></b>
<b>2.5</b>	<b><math>75 \leq X &lt; 80</math></b>	<b>0</b>	<b><math>X &lt; 60</math></b>

**RCPD** To arrange for accommodation a student should contact the Resource Center for People with Disabilities at <https://www.rcpd.msu.edu> or 517-353-9642

**Important Dates**

09/02/2020	Class begins
09/09/2020	Open adds end (8:00pm)
09/09/2020	Last day to drop with no grade reported (8:00pm)
12/18/2020	Class ends

**Late Work Policy:** Late work will not be accepted. However, under exceptional conditions please inform the instructional team before the due date and time so that accommodation can be made accordingly (please provide documented proof for late work.)

**Attendance policy** Attendance is mandatory for synchronous online classes like STT180. If a student is unable to attend any sessions, owing to health or other reasons, it is important for you to communicate with the instructional team at the earliest to avoid points being deducted for non-participation.

**Student continuity** In a situation if you are unable to engage in course content for a prolonged period it is critically important for you to communicate with your instructor promptly. We anticipate that some students may encounter interruptions to their studies for any number of reasons (e.g., illness, need to provide medical or child care, sustained loss of internet, etc.) and have plans in place accordingly. To provide built-in flexibility to students as they progress through their coursework this semester, the lowest score of the in-class assignments and 3-2-1 assignments will be dropped at the end of the semester before grades are tabulated.

In extreme cases where a student cannot reliably progress through course content for more than one week, they should inform the instructional team immediately, and if the student can provide documentation of the obstacle they face, we intend to work hard to accommodate their situation with empathy.

**Instructor continuity** We have an instructional team for STT 180 and we will have pre-recorded videos for the class. Thus, we do not anticipate any issues arising if the instructor is absent for an extended period.

## Learning objective for STT 180:

Week	Module		Date	Assigned Reading
1	1	<ul style="list-style-type: none"> <li>Introduction</li> <li>Understand the various component of R/Rstudio (wd, working environment, console, source pane), how the use help for arguments and functions.</li> </ul>	Sept 2	An Introduction to R: chapter 1.1-1.7
2		<ul style="list-style-type: none"> <li>Understand the basic know how of the R programming language               <ul style="list-style-type: none"> <li>Function(arg, arg, opt arg)</li> <li>Apply basic functions, mean(), sd(), which.min(), etc. is.NA()</li> <li>Store values as objects (using &lt;-, =)</li> </ul> </li> </ul>	Sept 9	RPDS: chapter 1, 2.4 - 2.8
3		<ul style="list-style-type: none"> <li>Use concepts of data ownership, possession, and stewardship to interpret a data analysis scenario. Define intellectual property in the context of data science. (Assessment 2-3 scenarios of concepts)</li> <li>Given a context, identify a possible ethical issue involved in data analysis.</li> </ul> <p>Read the article (cc can predict things that is considered private and decide whether its ethical to do so or not).</p>	Sept 14	Slides and video on concepts of ethics <a href="https://www.thedailybeast.com/how-visa-predicts-divorce">https://www.thedailybeast.com/how-visa-predicts-divorce</a>
		<ul style="list-style-type: none"> <li>Rmarkdown.               <ul style="list-style-type: none"> <li>Decide if it's better to use .rmd files or .r files.</li> </ul> </li> </ul>	Sept 16	NS: chapter 1, RPDS: chapter 3
Assessments		<ul style="list-style-type: none"> <li>Pre-assigned readings</li> <li>Random pop quiz (occasional)</li> <li>3-2-1 Homeworks (due every Monday)</li> <li>In-class assignments (with synchronous session)</li> <li>Homework 1 assigned.</li> </ul>		
	2	<ul style="list-style-type: none"> <li>Understand data structures in R               <ul style="list-style-type: none"> <li>Define the coercion hierarchy and, given a list of data formats, be able to rank the items in the list according to the hierarchy.</li> <li>Understand vector recycling and vectorization property in R</li> <li>Extract information from data frames and lists. Be able to extract info from dfs &amp; lists in more than one way.</li> </ul> </li> <li>Load into RStudio .csv, .rda, and files from URLs</li> </ul>	Sept 21	NS: chapter 2, RPDS: 4.1 - 4.8
		<ul style="list-style-type: none"> <li>Flex day</li> </ul>	Sept 23	
5		<ul style="list-style-type: none"> <li>Use the Base R functions               <ul style="list-style-type: none"> <li>Apply names, rownames, within, apply, etc. functions to data structures</li> <li>extract information</li> </ul> </li> </ul>	Sept 28	RPDS: 6.1 - 6.4

		<ul style="list-style-type: none"> <li>do transformations (subsetting).</li> </ul>		
		<ul style="list-style-type: none"> <li>Use tidyverse <ul style="list-style-type: none"> <li>Familiarize with tidy, dplyr packages and their functions</li> </ul> </li> </ul>	Sept 30	RPDS: 6.5
Assessments		<ul style="list-style-type: none"> <li>Pre-assigned readings</li> <li>Random pop quiz (occasional)</li> <li>3-2-1 Homeworks (due every Monday)</li> <li>In-class assignments (with synchronous session)</li> </ul>		
6	3	<ul style="list-style-type: none"> <li>Conduct Exploratory Data analysis to identify and summarize the structure of and variables and the relationships between them. Do this by: <ul style="list-style-type: none"> <li>Identifying the appropriate descriptive to summarize a variable's distribution</li> <li>Computing &amp; interpreting summary statistics</li> <li>Creating graphs that display contrasts and relationships</li> <li>Create graphical representations of summary statistic</li> </ul> </li> </ul>	Oct 5	NS: chapter 3, RPDS: 5.1 - 5.2
	Exam covering module 1 and 2 synchronous online		Oct 7	
7	3	<ul style="list-style-type: none"> <li>(contd)Conduct Exploratory Data analysis to identify and summarize the structure of and variables and the relationships between them. Do this by: <ul style="list-style-type: none"> <li>Identifying the appropriate descriptive to summarize a variable's distribution</li> <li>Computing &amp; interpreting summary statistics</li> <li>Creating graphs that display contrasts and relationships</li> <li>Create graphical representations of summary statistics.</li> </ul> </li> </ul>	Oct 12	NS: chapter 4, RPDS: 5.3 - 5.6
		<ul style="list-style-type: none"> <li>Given a context or research question, identify the most appropriate graph in response and produce it with ggplot()</li> <li>Identify ethical issues involved in data visualization.</li> </ul> <p>If students are asked to create two visualization of a dataset, decide which one is a more honest representation of the data structure</p>	Oct 14	
Assessments		<ul style="list-style-type: none"> <li>Pre-assigned readings</li> <li>Random pop quiz (occasional)</li> <li>3-2-1 Homeworks (due every Monday)</li> <li>In-class assignments (with synchronous session)</li> <li>Homework 2 assigned</li> </ul>		
8	4	<ul style="list-style-type: none"> <li>SWBAT write simple functions</li> <li>SWBAT analyze a function in terms of its efficiency and readability</li> </ul>	Oct 19	

		<ul style="list-style-type: none"> <li>Use conditional statements.</li> <li>Write for, while, repeat loops</li> </ul> <p>Explain factors influencing efficiency of loops by citing advantage of R's vectorization property or using pre-existing functions.</p>	Oct 21	
9		<ul style="list-style-type: none"> <li>Write for, while, repeat loops</li> <li>Explain factors influencing efficiency of loops by citing advantage of R's vectorization property or using pre-existing functions.</li> <li>Review for Midterm 2</li> </ul>	Oct 26	
Assessments		<ul style="list-style-type: none"> <li>Pre-assigned readings</li> <li>Random pop quiz (occasional)</li> <li>3-2-1 Homeworks (due every Monday)</li> <li>In-class assignments (with synchronous session)</li> </ul>		
	Combination of in-class and take-home covering module 3 and 4		Oct 28	
10	5	<ul style="list-style-type: none"> <li>Understand simulations and some associated functions (sample (), replicate (), rnorm (), etc.)</li> <li>Define the sampling distribution of a sample statistic as a model of the behavior of that statistic (in terms of center and dispersion) for repeated RS of the same size. <ul style="list-style-type: none"> <li>Identify where the distribution is centered</li> <li>Describe what the variability of the distribution signifies.</li> </ul> </li> <li>Anticipate the characteristics of a sampling distribution using the CLT. Identify instances where the CLT does not help predict the characteristics of a sampling distribution.</li> </ul>	Nov 2	NS: Chapter 7, OIS 4.1-4.4, 6.1
		<ul style="list-style-type: none"> <li>Describe the roles sampling distributions and CLT play in inference.</li> </ul>	Nov 4	NS: Chapter 8 OIS 5.1
11		<ul style="list-style-type: none"> <li>Given a context, express a research question in terms of two competing claims about a model parameter.</li> </ul>	Nov 9	NS: Chapter 9
		<ul style="list-style-type: none"> <li>Do hypothesis testing and build confidence intervals for one mean, median, and proportion.</li> </ul>	Nov 11	NS: Chapter 10, OIS 4.4-4.5
Assessments		<ul style="list-style-type: none"> <li>Pre-assigned readings</li> <li>Random pop quiz (occasional)</li> <li>3-2-1 Homeworks (due every Monday)</li> <li>In-class assignments (with synchronous session)</li> <li>Homework 3 assigned</li> </ul>		
12	6	<ul style="list-style-type: none"> <li>Evaluate whether a bivariate dataset can be represented by linear models.</li> <li>Compute and extract simple linear regression models from R.</li> <li>Use residual diagnostics to assess whether OLS conditions are met.</li> </ul>	Nov 16	RPDS: Chapter 9

		<ul style="list-style-type: none"> <li>Formulate and interpret linear models with categorical predictors</li> <li>Interpret multiple linear regression coefficients and model fit.</li> </ul>	Nov 18	NS: Chapter 11, OIS 7.1-7.3
13		<ul style="list-style-type: none"> <li>Perform KNN analysis</li> <li>Use Cross-validation to determine the best K in the KNN algorithm.</li> <li>Describe K means learning algorithm.</li> </ul>	Nov 23	NS: Chapter 12, 13, OIS 7.4, 8.1-8.3
<b>Assessments</b>		<ul style="list-style-type: none"> <li>Pre-assigned readings</li> <li>Random pop quiz (occasional)</li> <li>3-2-1 Homeworks (due every Monday)</li> <li>In-class assignments (with synchronous session)</li> </ul>		
	Combination of in-class and take-home covering module 5 and 6		Nov 25	
14	7	<b>Learn some of the essentials data scientist tools:</b> <ul style="list-style-type: none"> <li>RShiny</li> <li>Text analysis</li> <li>Web scraping</li> <li>Relational databases</li> <li>SQL in R</li> </ul>	Nov 30	
			Dec 2	
15			Dec 7	
			Dec 9	<b>Presentations review</b>
16			Dec 14	<b>Project write-up due</b>
			Dec 16	<b>Peer Review Due</b>
		Final Exam: Friday, Dec 18 2020 7:45am - 9:45am (Note: there is no final exam for this class)	Dec 18	