To: Department of Mathematical Sciences
From: Academic Affairs Committee
Date: September 25, 2018
Subject: Minor in Actuarial Science

Background:
The Department has received inquiries (primarily from Engineering and Business) about a Minor in Actuarial Science. AAC has modeled the proposed minor (found at the bottom of this page) on the actuarial science major. The current B.S. in Actuarial Sciences has coursework leading to three exams of the Society of Actuaries (FM, P, MFE) and three Validation by Educational Experience (VEE) topics (Economics, Accounting and Finance, and Statistics).

The coursework for the three exams includes:
- Exam FM – MA 273 (C: Calculus II, MA 166 or MA 230);
- Exam P – STAT 516 (P: MA 261);
- Exam MFE – MA 490 4 cr. (P: MA 273, F 301 or possibly F 305).
  - The MFE Exam changed to Exam IFM (Investment and Financial Markets) in July 2018. The Department has until Spring 2020 to update the requirements.

Note: Starting in Spring 2019 the department will offer STAT 490 Modern Statistical Modelling and Learning that will address the curriculum for a 4th actuarial exam SRM (Statistics for Risk Modeling). In Fall 2019 the Department will offer STAT 490 – Data Analysis that will address a 5th actuarial exam PA (Predictive Analytics).

The coursework for the three required VEE topics includes:
- Economics VEE – ECON 20101 (Intro. to Microeconomics) and ECON 20201 (Intro. to Macroeconomics);
- Accounting and Finance VEE – BUS 20100 (Intro. to Financial Accounting) and BUS 30100 (Financial Management);

Proposal:
AAC recommends that the 2019-20 Undergraduate Bulleting reflect the following requirements for the Minor in Actuarial Science.

To earn a Minor in Actuarial Science, a student must complete a two Calculus Course sequence (MA 165/166 or MA 229/230), coursework leading to two actuarial exams, and coursework for one VEE.

Samples:
A sample Actuarial Minor for Business:
MA 229, 230, 273, MA 490 – IFM, Econ 201, 202; the additional courses would be MA 230, 273, 490-IFM.

A sample Actuarial Minor for Engineering, Math, or Sciences:
MA 165, 166, 261, 273, STAT 516, 517; the additional courses would be MA 273, STAT 516, 517.
AAC recommends that the Department adopt STAT 490/598 Modern Statistics Modelling and Learning for Spring 2019. The syllabus for the course is attached.

AAC intends to come back to the department with a plan to make this course recurring.
STAT 490/598 Modern Statistics Modelling and Learning

CRN: 24785/ MW 4:30 – 5:45PM KT 220

Course Description: This course provides an introduction to supervised learning, with a focus on regression and classification methods. Both theory and application of learning methods are emphasized. Some unsupervised learning methods are also discussed.

Credit Hours: 3 credits

Prerequisite: STAT 516 and STAT 512 with grade of C– or higher. Experience with R programming is expected.

Instructor: Yihao Deng

- Office: KT 286
- Office hours: MTW 12:00 – 1:30PM
- Phone: 418-4185
- Email: dengy@pfw.edu

Important Dates:

- First class meeting: January 7, 2019
- Last class meeting: April 24, 2019
- Martin Luther King Jr. holiday: January 21, 2019 (no class)
- Spring Break: March 4, 2019 – March 10, 2019 (no class)
- Last day to withdraw online: March 15, 2019

Text: Hard copies of the following texts are not required.

- An introduction to statistical learning (ISL, free e-copy online)
- The element of statistical learning (ESL, free e-copy online)

Course Website: Course related materials are hosted in blackboard and github repository. A short instruction on github basics is available at https://github.com/dengy-fw/stat-learning.

Computing: We will use R eco-system as our computing environment including RStudio and RMarkdown. There are many sources where you can learn basic R programming and RMarkdown. Some online resources are freely available to you, for example:

- R at https://www.r-project.org
- RStudio at https://www.rstudio.com (open source R desktop)
- Courses at https://www.datacamp.com (all courses are free for six months, invitation emails are sent already)
- Courses at https://www.edX.org (free if you choose not to pursue the certificate)
- RMarkdown official website at https://rmarkdown.rstudio.com/index.html

Homework: There will be 6 homework accounting for 48% (8% each) of your course grade. Homework will be assigned after relevant topics are covered in class (roughly one homework
each chapter) and due date will be announced. All homework must be completed using RMarkdown. Late submission will not be accepted.

**Test:** There will be a midterm (20%, around spring break) and a final (20%). Tests also need to be completed using RMarkdown.

**Group Presentation:** The class will be divided into 5 – 6 groups, and each group will model real life data and present the result (15 minutes) during the final week. Group assignment will be available in blackboard at week 2 and presentation accounts for 12% of your course grade. More detail on group presentation will be provided soon.

**Grading Policy:**

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<table>
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<tbody>
<tr>
<td>Homework:</td>
<td>48%</td>
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<tr>
<td>Midterm:</td>
<td>20% (around spring break)</td>
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<tr>
<td>Presentation:</td>
<td>12%</td>
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<td>Final:</td>
<td>20%</td>
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Based on your percentage grade, letter grade will be assigned as follows:

- A: > 90.0  B+: 85.0 – 89.9  B: 80.0 – 84.9  C+: 75.0 – 79.9  C: 70.0 – 74.9
- D+: 65.0 – 69.9  D: 60.0 – 64.9  F: < 60.0

**Tentative schedule:**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Chapter 1: Introduction and brief overview of RStudio and RMarkdown</td>
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<tr>
<td>2</td>
<td>Chapter 2: Statistical learning: supervised and unsupervised</td>
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<td>3</td>
<td>Chapter 3: Regression (review); Chapter 6: Model selection</td>
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<td>4</td>
<td>Chapter 6: Model regularization</td>
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<td>5</td>
<td>Chapter 4: Classification: logistic regression and LDA</td>
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<td>6</td>
<td>Chapter 4: Classification: QDA; Chapter 5: Resampling: cross-validation</td>
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<tr>
<td>7</td>
<td>Chapter 5: Resampling: cross-validation and bootstrap</td>
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<td>8</td>
<td>Chapter 8: Tree-based methods: decision trees</td>
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<td>9</td>
<td>Spring break (no class)</td>
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<tr>
<td>10</td>
<td>Chapter 8: Tree-based methods: Bagging, random forest and boosting</td>
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<td>11</td>
<td>Chapter 10: Unsupervised learning: PCA</td>
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<td>12</td>
<td>Chapter 10: Unsupervised learning: Clustering Analysis</td>
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<tr>
<td>13</td>
<td>Chapter 9: Support vector machines</td>
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<tr>
<td>15</td>
<td>Chapter 11: Neural networks (ESL book)</td>
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*Note: labs are incorporated into the discussion of each chapter*