On 5/28/2018, the CAS revised the **syllabus**. The only substantive change was:
Sections 4.1 through 4.4; the Linear Discrimination Analysis portion of Section 4.4 will not be tested.
This seems to add to the syllabus the introduction to Section 4.4 and Section 4.4.1 of An Introduction to Statistical Learning.

Bayes Theorem is mentioned in Section 4.4.1 of An Introduction to Statistical Learning.
Bayes Theorem is discussed in Section 6 of "Mahler's Guide to Statistical Learning."

It is pointed out that linear discrimination analysis has some advantage over logistic regression:
"When the classes are well-separated, the parameter estimates for the logistic regression model are surprisingly unstable. Linear discrimination analysis does not suffer from this problem."
"If n (the sample size) is small and the distribution of the predictors X is approximately normal in each of the classes, the linear discrimination model is again more stable than the logistic regression model."
"Linear discrimination analysis is popular when we have more than two response classes."
(Logistic Regression is applied to a yes/no or true/false situation.)

The CAS has issued the **Tables** for MAS-1.
http://www.casact.org/admissions/syllabus/MASI_Tables.pdf
Read the statement on the second page regarding AIC and BIC.

The CAS has issued 4 **Sample Questions** for MAS-1.
http://www.casact.org/admissions/MAS-I_Sample_Questions.pdf

1, p. 2, in Table Contents put in bold: **Stationary Distributions of Markov Chains**

1, p. 475, Q. 18.97, the first row second column of the matrix should be **0.10**:

$$\begin{array}{ccc} F & R & B \end{array}$$
$$\begin{pmatrix} 0.82 & \mathbf{0.10} & 0.08 \\ 0.60 & 0.05 & 0.35 \\ 0.00 & 0.00 & 1.00 \end{pmatrix}$$

1, p.668: I is the identity matrix with ones along the diagonal and zeros elsewhere

2, p.246, Solution 20.35: $S(x) = \int_x^\infty f(t)\,dt = \int_x^\infty t\,e^{-t}\,dt = e^{-x} + xe^{-x}$.

2, p. 331, sol. 25.2: $f'(x) = 720x(1-x)^7$ **-** $2520x^2(1-x)^6$. Final answer is OK.

3, p. 95, solution 4.24: We match at two percentiles, getting two equations in two unknowns.

For the Loglogistic, $F(x) = \frac{(x/\theta)^\gamma}{1 + (x/\theta)^\gamma}$.

At 8 feet the chance of failure is 50%, and at 16 feet the chance of failure is 80%.

$0.5 = F(8) = \frac{(8/\theta)^\gamma}{1 + (8/\theta)^\gamma}$. $\Rightarrow 8 = \theta\{1/0.5 - 1)^{-1/\gamma} = \theta$.

$0.8 = F(16) = \frac{(16/\theta)^\gamma}{1 + (16/\theta)^\gamma}$. $\Rightarrow 16 = \theta\{1/0.8 - 1)^{-1/\gamma} = \theta\, 4^{1/\gamma}$. $\Rightarrow 16 = (8)\,(4^{1/\gamma})$. $\Rightarrow \gamma = 2$.

The chance of <u>success</u> is: $1 - F(x) = \frac{1}{1 + (x/8)^2}$.

The chance of success at 40 feet is: $\frac{1}{1 + (40/8)^2} = 1/26 = 3.85\%$.

3, pages 939, 982, 996, 997:

Residual Sum of Squares = Within Sum of Squares = $\sum_i \sum_j X_{ij}^2 - \sum_{\mathbf{j}} \left\{ \sum_{\mathbf{i}} \mathbf{X_{ij}} \right\}^{\mathbf{2}} \;/\; \mathbf{a_j}$.

3, pages 947, add two sentences:
The 1% critical value is 9.780 < 15.30. The p-value is 0.32%.
Thus we reject the null hypothesis that there is no difference in responses for the different varieties of wheat.

The 1% critical value is 10.925 < 36.08. The p-value is 0.045%.
Thus we reject the null hypothesis that there is no difference in responses for the different types of fertilizer.

3, p. 983, solution 27.13: $\mathbf{909}^2$ = sample variance

$(17)(909^2) + (5)(579^2) + (20)1070^2) = 38{,}620{,}\mathbf{9}82$.

$$F = \frac{\text{average between class sum of squares}}{\text{average within class sum of squares}} = \frac{5{,}133{,}287 / (3 - 1)}{38{,}620{,}982 / (17 + 5 + 20)} = \mathbf{2.791}.$$

3, p. 1115: **Order Statistics (Section 31) is still on the syllabus.**

4, pages 103, 3rd line from the bottom: **Model SS**= $\hat{\beta}^2 \Sigma x_i^2 = \hat{\beta} \Sigma x_i y_i$.

4, pages 232: $\hat{\sigma}^2$ = RSS/(N - **p** - 1) = (TSS - **Model SS**)/(10 - 3) = (264.4 - 225.01)/7 = 5.627.

4, pages 240: $\hat{\sigma}^2$ = **R**SS / (N - p - 1) is an unbiased estimator of σ^2.

4, pages 265: $F = \frac{R^2}{1 - R^2} \frac{N - \mathbf{p} - 1}{\mathbf{p}}$

4, pages 300, Q.10.66: while the **R**SS resulting from the second fit is 2087

4, page 302, Q. 10.69, and page 326 soluion 10.69:
There betas should have been labeled 1, 2 and 3.

4, bottom of page 565: Error (Residual) SS = 10.4921, with 30 - 3 = 27 degrees of freedom.
Model (Regression) SS = 775.826 with 3 - 1 = 2 d.f.

4, page 580, sol. 19.8, line 11: 3184 - 2886 = 29**8**

4, page 590: Model (Regression) Sum of Squares $\equiv \sum(\hat{Y}_i - \bar{Y})^2$.

TSS = Residual Sum of Squares + Model Sum of Squares.
The total variation has been broken into two pieces: that explained by the regression model, Model Sum of Squares, and that unexplained by the regression model, Residual Sum of Squares.

Source of Variation	Degrees of Freedom
Model	k
Residual (Error)	N - k - 1
Total	N - 1

$$R^2 = \frac{\sum(\hat{Y}_i - \bar{Y})^2}{\sum(Y_i - \bar{Y})^2} = \text{(Model SS) / TSS} = 1 - \text{(Residual SS) / TSS} = 1 - \frac{\sum \hat{\varepsilon}_i^2}{\sum y_i^2} = 1 - \frac{\sum(\hat{Y}_i - Y_i)^2}{\sum(Y_i - \bar{Y})^2}.$$

4, page 595: To test the hypothesis that all of the slope coefficients are zero compute the

$$\text{F-Statistic} = \frac{\textbf{(Model SS)} / k}{(\textbf{Residual SS}) / (N - k - 1)}$$

5, page 37, solution 2.15: $\theta^{(2)} = \theta^{(1)} + U^{(1)} / \tau^{(1)} = 5 + 41.0096/8 =$ **10.1262**.

5, page 149, Q. 6.16: $\begin{pmatrix} 0.0046\mathbf{8}06 & -0.0014686 \\ -0.0014686 & 0.00061364 \end{pmatrix}$

5, pages 161-162: solutions 6.8 and 6.9 should be switched

5, p. 269, sol. 12.7: $(6\mathbf{8}8 - 961) / \sqrt{961^3 / 150} =$ **-0.112**

5, p. 269, sol. 12.10: $(\mathbf{5} - \mathbf{4.2}) / \sqrt{(4.2)(1 - 4.2/20)} =$ **0.439**

5, page 275, solution 12.34: a **heavier lefthand tail** than a Normal Distribution

5, p. 294: Thus the deviance is **0.2822**, and the Chi-Square Goodness of Fit Statistic is **0.2858**.

5, page 323, solution 14.25: 1.0874/0.3162 = 3.4**3**9.
The p-value is: $2\{1 - \Phi[3.4\mathbf{3}9]\} = 0.06\%$. Final solution is okay.

6, pages 10 and 183, the order of the inequality is wrong: Training MSE **<** Test MSE.

6, page 53, solution 3.8: remove the final line. The answer is 0.278.

6, page 57, solution 3.21: remove the final line. The answer is 27,127.

6, pages 62 and 185, for step 2 for backwards stepwise selection:
Consider all models that subtract one predictor from M_k.

6, page 125, Q. 8.8, missing final sentence: Briefly comment on these results.

6, page 181, Q. 15.2, the values in the columns are reversed:

Model	Residual Sum of Squares	Degrees of Freedom RSS
1	3690	260
2	3785	262

9, p.122, sol. 9.4: $(1 - B/4)(1 + B2/5) = 1 + 0.15B - 0.10B^2$.

$(1 + 0.15B - 0.10B^2)\, w_t = w_t + 0.15w_{t-1} - 0.10\, w_{t-2}$.

$\Rightarrow x_t = w_t + 0.15\, w_{t-1} - 0.10\, w_{t-2}$. An MA(2) model with $\beta_1 = \mathbf{+}0.15$ and $\beta_2 = -0.10$.

9, p.168 next to last line:
$x_t = 2.41\, x_{t-1} - 2.03\, x_{t-2} + 0.83\, x_{t-\mathbf{3}} - 0.21\, x_{t-\mathbf{4}} + w_t + 0.54w_{t-1} - 0.30\, w_{t-2}$.

9, page 223: Q. 16.1 in Time Series is identical to Q. 16.5 in Regression.

10, pages 5 and 166, in the algorithm : 3. Exchange the values in **position k** and position x.

10, page 11, Q.2.6: **ten** random numbers

10, page 14, solution 2.6, needs to be totally revised in order to match the algorithm in Ross:
First simulate a random integer from 1 to 8: 1 + largest integer in (8)(0.722) = 1 + 5 = 6.
Now exchange the number in the 8th position with the number in the 6th position to get:
1, 2, 3, 4, 5, 8, 7, 6.
Now simulate a random integer from 1 to 7: 1 + [(7)(0.032)] = 1 + 0 = 1.
Exchange the number in the 7th position with the number in the 1st position to get:
7, 2, 3, 4, 5, 8, 1, 6.
Simulate a random integer from 1 to 6: 1 + [(6)(0.534)] = 1 + 3 = 4.
Exchange the number in the 6th position with the number in the 4th position to get:
7, 2, 3, 8, 5, 4, 1, 6.
Simulate a random integer from 1 to 5: 1 + [(5)(0.969)] = 1 + 4 = 5.
Exchange the number in the 5th position with the number in the 5th position; the sequence remains the same: 7, 2, 3, 8, 5, 4, 1, 6.
Simulate a random integer from 1 to 4: 1 + [(4)(0.398)] = 1 + 1 = 2.
Exchange the number in the 4th position with the number in the 2nd position to get:
7, 8, 3, 2, 5, 4, 1, 6.
Simulate a random integer from 1 to 3: 1 + [(3)(0.814)] = 1 + 2 = 3.
Exchange the number in the 3rd position with the number in the 3rd position; the sequence remains the same: 7, 8, 3, 2, 5, 4, 1, 6.
Simulate a random integer from 1 to 2: 1 + [(2)(0.165)] = 1 + 0 = 1.
Exchange the number in the 2nd position with the number in the 1st position to get:
8, 7, 3, 2, 5, 4, 1, 6.
The random permutation is: **8, 7, 3, 2, 5, 4, 1, 6**.

10, page 24: **Ideally exam questions should specify whether large random numbers correspond to large or small values of the simulated variable, letting you know whether to set u equal to F(x) or S(x)**.
If in an exam question it is not stated which way to perform the method of inversion, set F(x) = u, since this is the principal manner shown in Introduction to Probability Models, and then solve for x. (See Proposition 11.1 in Introduction to Probability Models by Ross. However, Example 11.3 mentions that one can use either of the two possibilities: u = F(x) or u = S(x).)

10, pages 127 and 168:

0. Find a density g and a constant c such that c g(x) ≥ f(x) for all x in the support of **f**.

10, page 162, sol. 12.1:

$f(x) / \{c\ g(x)\} = (\theta^{-\alpha}\ e^{-x/\theta} x^{\alpha-1} / \Gamma[\alpha]) / \{(\alpha^{\alpha}\ e^{1-\alpha} / \Gamma(\alpha))\ e^{-x/\alpha\theta} / \alpha\theta)\} = \{e\ \mathbf{x} / (\alpha\theta)\}^{\alpha-1}\ e^{x(1-\alpha)/(\alpha\theta)}$.

Final answer is OK.