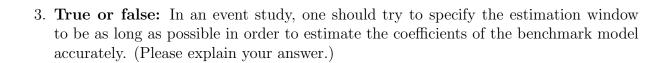
Last Name:	First Name:
M.I.T. ID#	
	15.450 Final Exam
	Professor Hui Chen
	Spring 2020
Please read the following inst	tructions carefully.
• Please write your name	e and MIT ID number on the first page.
• This exam lasts 90 min and 10:00 PM EDT on	utes. You can take the exam any time between 12:00 AM EDT $5/12/20$ .
	ersion of your answers on Canvas by 10:00 PM EDT. If you are nd-written exam, make sure to include all the pages.
	e notes and/or the textbooks listed on our syllabus during the anyone or use any on-line material.
	nswers and show your work, but try to be concise. Answers ill receive no credit. Wrong answers with partially correct work dit.
I hereby certify that I ans any on-line material.	wered the questions in this exam without consulting anyone or
Signature:	Date:

1.	Explain	the main	difference(	s) between	AIC an	d BIC for	model sel	ection.	
2.			ole of a consed estimate		biased $\epsilon$	estimator,	and an ex	cample of a	n incon-



4. **True or false:** One weakness of the value-at-risk (VaR) measure is that it requires returns to be normally distributed. (Please explain your answer.)

- 5. You are building a time-series model to predict the daily return volatility of the S&P 500 ETF (ticker 'SPY').
  - (a) How would you measure the variance of daily return  $\sigma_t^2$  of SPY using intra-day data (e.g. 5-minute returns)?

(b) Suppose you have constructed 10 potential features,  $x_{it}$  for i = 1, ..., 10, and you would like to construct a linear model to predict the (log) return variance on the next day:

$$\ln \sigma_{t+1}^2 = a + \sum_i b_i x_{it} + \epsilon_{t+1}.$$

Explain how you would build the model using best subset selection.

6.	Explain the meaning of the bias-variance trade-off in statistical learning. In particular, explain the meanings of the "bias" and "variance".
7.	When would we prefer to use LASSO over ridge regression to fit a linear model?

8.	You are helping a fintech startup building a model to predict the default risk of mort-
	gage borrowers. You have collected a large dataset on borrower characteristics (such
	as income and leverage), market information (such as house prices and interest rates),
	and loan performances (default or non-default).

(a)	Explain	how	you	would	apply	the	KNN	method	to	$\operatorname{predict}$	whether	a	borrower
	will defa	ult ir	n one	e year.									

(b) What advantages and disadvantages does KNN have compared to a logit model?