Having spent the first eighteen years of my life in China and then two and a half years studying at Caltech, I have definitely tasted the huge benefits that studying abroad can provide. Not only did I experience a completely different cultural atmosphere and academic system, but I also challenged myself by stretching out of my comfort zone and meeting people from various backgrounds. Therefore, I don't want to miss the opportunity that can give me another unique study abroad experience.

As an ACM major, I benefited a lot from the rigorous nature of Caltech ACM classes. Yet, having to deal with difficult problem sets sometimes distract me from fully digesting the materials and understanding the concepts and topics on a larger scale. Thus, I would benefit from the UK schooling system, where self-driven review and guided supervisions are valued. As an independent learner who usually finishes the sets alone, I won't have problems learning the materials on my own and comb through the rigorous proofs. Still, reviewing the problems with my supervisors instead of having to worry about the frustrating details and grades would save me time to review and synthesize the knowledge on a larger scale. I could also have the opportunity to communicate more with brilliant professors and peers to get insightful ideas through the supervision system. What's more, compared to the Caltech ACM department, the math department in a much larger school would provide more interesting classes that I can take in my field of interest.

As for social life, I have gotten used to the small and closely connected nature of Caltech, so it would greatly expand my horizon by experiencing the greater variety that UK schools can offer. Also, I have gone through the process of settling in an environment with a completely different language and culture, which made me more independent and confident in taking care of myself. Thus, I expect I could handle the cultural shock well and spend more of my energies on experiencing different lifestyles and meeting new people with unique backgrounds. I would also enjoy the variety of societies in UK schools. As a basketball lover that is not athletic enough for the varsity team, I often had trouble finding people at my level to play with at Caltech, which I think won't be a problem in UK. What's more, I am also looking forward to joining a movie or board game society for a term, which does not exist here at Caltech.

As someone who will probably not study or live in UK for the rest of my life, this ten-week program really appeals to me, as the distinctive academic system and social atmosphere in UK would provide me with a unique experience that I won't have in US and Caltech. I am excited to attend classes not offered at Caltech, immerse myself in a completely different society and make friends with distinct backgrounds. In this way, I would make the most of my undergraduate years and grow as both a student and a person as well.

2. PROGRAM FIT: Briefly describe how each program you are applying for fits in with your course of study at Caltech. If you are applying for several programs with a range of course types, provide this information in the order of your program preference with **#1 being your most preferred study abroad university.** **#1 Cambridge Lent Term**

Cambridge appeals to me the most because of its world-renowned reputation in mathematics and applied mathematics. By winter 2020, I would have completed all my major requirements at Caltech, which will provide me with enough backgrounds for my ACM courses at Cambridge. The classes offered in Lent Term are all extremely interesting to me. Further Complex methods will build on my knowledge in ACM95 and ACM101 to explore fascinating topics such as Gamma Functions, Riemann-Zeta Functions, and hypergeometric functions. It will also connect with MA108c and explore the effects of complex analysis on differential equations. Applied Probability has its direct connections with the topics in Caltech ACM116 and ACM216 such as stochastic process and Markov Chains and applies them to the interesting subjects such as generating functions, flow networks, and epidemiology. Statistical Modeling and Stochastic Financial Models are two fascinating courses that will apply the statistical inference knowledge I will learn in ACM157 in analyzing real data sets and financial markets. They will provide me with hands-on experience to data analysis with R language and prepare me for my future career in quantitative trading.

What's more, by winter 2020, I would have finished either my job search or my graduate school application, so I can entirely focus on experiencing the unique academic and social atmosphere in Cambridge and make good use of the outstanding ACM resources there.

#2 Cambridge Michelmas Term

ACM courses in Michelmas Term are also appealing to me. Probability and Measure is a good alternative to Caltech ACM117, where I can solidify my knowledge on probability and treat the topic in a more formal and rigorous way. Principles of statistics will continue my exploration of statistical inference in Caltech ACM157 and dig into topics such as inference methods for multivariate data, nonparametric techniques, and resampling (Monte Carlo) procedures. Cosmology and Number Theory, although less relevant to my future career or graduate study goals, will give me a chance to investigate interesting topics that I otherwise won't encounter.

More importantly, Michelmas Term is a time when new students come in, so I will be able to participate in the orientation programs and have more opportunities to meet with distinct people and join interesting societies.

Tripos: Mathematics
Part: II(C)
Term (Michelmas or Lent): Lent
Number of lectures: 24
Lecture times, if available: TuThS 12 AM
Caltech units: 9
Caltech evaluator:
Type of Caltech credit: General
State CIT equivalent course, if applicable:
Course description: This course is complementary to Part II Principles of Statistics, but takes a more applied perspective. There will be approximately 16 hours of lectures and eight hours of practical classes. The lectures will cover linear and generalised linear models, which provide a powerful and exible framework for the study of the relationship between a response (e.g. alcohol consumption) and one or more explanatory variables (age, sex etc.).

In the practical classes, we will learn how to implement the techniques and ideas covered in the lectures by analysing several real data sets. We will be making extensive use of the statistical computer programming language R, which can be downloaded free of charge and for a variety of platforms from http://www.stats.bris.ac.uk/R/. An excellent editor for R can be downloaded from http://www.rstudio.com/products/RStudio/.

This course should appeal to a broad range of students, including those considering further research in any aspect of Statistics and those considering careers in data-intensive industries (investment banking, insurance, etc.). Those interested might like to try downloading R and experimenting with one of several excellent tutorials available by following the links at http://www.statslab.cam.ac.uk/~pat/

3. Class/Module title: Applied Probability
Tripos: Mathematics
Part: II(D)
Term (Michelmas or Lent): Michelmas
Number of lectures: 24
Lecture times, if available: MWF 12AM
Caltech units: 9
Caltech evaluator: Konstantin Zuev
Type of Caltech credit: General
State CIT equivalent course, if applicable: ACM116
Course description: This course provides an introduction to some of the probabilistic models used to study phenomena as diverse as queueing, insurance ruin, and epidemics. The emphasis is on both the mathematical development of the models, and their application to practical problems. For example, the queueing models studied will be used to address issues that arise in the design and analysis of telecommunication networks. The material is likely to appeal to those who enjoyed Part IA Probability; Markov Chains is useful, but the style of the course, involving a mix of theory and applications, will more closely resemble the earlier course. Probability and Measure is a loosely related Part II course.

4. Class/Module title: Stochastic Financial Models
Tripos: Mathematics
Part: II(D)
Term (Michelmas or Lent): Michelmas
Number of lectures: 24
Lecture times, if available: TuThS 10AM
Caltech units: 9
Caltech evaluator: Jaska Cvitanic
Type of Caltech credit: General
State CIT equivalent course, if applicable: Ma214
Course description: This is concerned with the pricing of financial assets under uncertainty. It builds towards a presentation of the celebrated Black-Scholes formula for the price of an option on stocks. The holder of a call option on a stock has the right to purchase one unit of that stock at a specified `strike' price within a designated time period. The holder hopes that within the period the stock price will go above the strike price whereupon the option may be exercised with the stock being bought at the strike price and sold immediately at the higher current price to yield a profit. What is the fair price to charge for such an option? In seeking an answer to this question, the course introduces some important ideas of probability theory including martingales and Brownian motion. Deciding when the holder should exercise the option leads to the techniques of dynamic programming and optimal stopping which are applicable throughout applied probability and statistics.
The main prerequisite for this material is Part IA Probability if you liked that course then you should enjoy this one. Probability and Measure is recommended as a companion course, but it is not strictly necessary. No previous knowledge of economics or finance is necessary. It complements, but does not rely on, Markov Chains. To get a better idea of the sort of problems the course is seeking to tackle it is worth browsing in the book Option, Futures and Other Derivative Securities by J. Hull (Prentice-Hall, 2nd Ed. 1993).

#2 Cambridge Michelmas Term

Total CIT Units for term abroad:36
Course by Correspondence/Units: 0

1. Class/Module title: Cosmology
Tripos: Mathematics
Part: II(C)
Term (Michelmas or Lent): Michelmas
Number of lectures: 24
Lecture times, if available: MWF 9AM
Caltech units: 9
Caltech evaluator:
Type of Caltech credit: General
State CIT equivalent course, if applicable:
Course description: The principal aim of this course is to provide the outlines of our current

3. PROPOSED COURSE LIST: For each program, and in order of preference, list each of the courses you wish to take according to the directions below and in the handout **Proposed Course List Guidelines. You should consult the handout on each program to ensure that you fully understand the program requirements. NOTE THAT YOU MUST USE THE CURRENT YEAR'S COURSE LIST AT THE STUDY ABROAD UNIVERSITY, AS THE NEXT YEAR'S CLASS LIST IS NOT AVAILABLE UNTIL THE SUMMER MONTHS.** Students selected for study abroad sometimes have to make changes in their proposed class list, due to changes in the courses available, but will have help in doing so.

#1 Cambridge Lent Term

Total CIT Units for term abroad:36
Course by Correspondence/Units: 0

1. Class/Module title: Further Complex Methods
Tripos: Mathematics
Part: II(C)
Term (Michelmas or Lent): Lent
Number of lectures: 24
Lecture times, if available: MWF 9AM
Caltech units: 9
Caltech evaluator:
Type of Caltech credit: General
State CIT equivalent course, if applicable:
Course description: This course is a continuation in both style and content of Part IB Complex Methods. It will appeal to anyone who enjoyed that course. The material is classical | much of it can be found in Whittaker and Watson's `Modern Analysis', written in 1912. The passage of time has not diminished the beauty of material, though the Faculty Board decided against naming the course `Modern Analysis'.
The course starts with revision of Complex Methods and continues with a discussion of the process of analytic continuation, which is at the heart of all modern treatments of complex variable theory. There follows a section on special functions, including the Gamma function (which is basically the factorial function when looked at on the real line, but on the complex plane it really blossoms) and the Riemann zeta and its connection with number theory. Then the theory of series solutions of differential questions in the complex plane is developed, and suddenly the treatment given in Part IA Differential Equations makes sense. Naturally, the messy business of actually solving specific equations by series is not in the style of the course. Particularly important are those equations that have exactly three singular points, all regular. This leads to a study of the properties of the delightful hypergeometric function, of which almost every other function you know can be thought of as a special case. This is the high point of the course, involving nearly all the theory that has preceded it.
There are no prerequisites besides a working knowledge of IB Complex Methods.

2. Class/Module title: Statistical Modeling understanding of the evolution of the universe, from the Big Bang to the present day. An understanding of the early universe requires some knowledge of statistical mechanics, which is therefore taught as part of the course. Although modern cosmology is based on Einstein's theory of gravity, General Relativity, the basic equations actually follow from Newtonian gravity, given the equivalence of mass and energy via $E = mc^2$. The course will begin with a derivation of these equations and an investigation of their cosmological consequences. Statistical Mechanics will then be introduced and applied to the early universe. The course prerequisites are a knowledge of Newtonian dynamics and the rudiments of Quantum Mechanics and Special Relativity.

2. Class/Module title: Number Theory
Tripos: Mathematics
Part: II(C)
Term (Michelmas or Lent): Michelmas
Number of lectures: 24
Lecture times, if available: MWF 10AM
Caltech units: 9
Caltech evaluator: Ashay Burungale
Type of Caltech credit: General
State CIT equivalent course, if applicable: Ma7
Course description: Number Theory is one of the oldest subjects in mathematics and contains some of the most beautiful results. This course introduces some of these beautiful results, such as a proof of Gauss's Law of Quadratic Reciprocity, and a proof that continued fractions give rise to excellent approximations by rational numbers. The new RSA public codes familiar from Part IA Numbers and Sets have created new interest in the subject of factorisation and primality testing. This course contains results old and new on the problems. On the whole, the methods used are developed from scratch. You can get a better idea of the avour of the course by browsing Davenport The Higher Arithmetic CUP, Hardy and Wright An introduction to the theory of numbers (OUP, 1979) or the excellent Elementary Number Theory by G A and J M Jones. (Springer 1998).

3. Class/Module title: Probability and Measure
Tripos: Mathematics
Part: II(D)
Term (Michelmas or Lent): Michelmas
Number of lectures: 24
Lecture times, if available: MWF 11AM
Caltech units: 9
Caltech evaluator: Houman Owhadi
Type of Caltech credit: General
State CIT equivalent course, if applicable: ACM117
Course description: Measure theory is basic to some diverse branches of mathematics, from probability to partial differential equations. This course combines a systematic introduction to measure theory with an account of some of the main ideas in probability. You will be familiar

with the Riemann integral from Parts IA and IB and have done some elementary probability in IA. The expectation operator of probability behaves somewhat like the integral, and in this course we see that they are both examples of some more general integral. These general integrals and the measures which underlie them have advantages over the Riemann integral, even for functions defined on the reals. In Part IA the definition and properties of expectation were only partially explored and here we do it more fully. If you like to see how a substantial and coherent mathematical theory is put together, you will enjoy the measure theory part of this course, and this will be essential to any further work you do in analysis. It also underpins the probability which provides motivation and application throughout the course. The course ends with the Strong Law of Large Numbers and Central Limit Theorem, both of which are of real practical importance, being the mathematical basis for the whole of statistics. A good book to read for the early part of the course is Probability with Martingales, by D. Williams (CUP, 1991).

4. Class/Module title: Principles of Statistics
Tripos: Mathematics
Part: II(D)
Term (Michelmas or Lent): Michelmas
Number of lectures: 24
Lecture times, if available: MWF 12AM
Caltech units: 9
Caltech evaluator: Konstantin Zuev
Type of Caltech credit: General
State CIT equivalent course, if applicable: ACM157
Course description: In Part IB Statistics, an introduction to the main statistical problems and inference techniques was given, including parameter estimation, hypothesis testing and the construction of confidence sets in a variety of examples, including specific families of distributions and models. The Principles of Statistics course aims to give a unified perspective on these problems, and develops the main mathematical theory that underpins these basic principles of statistical inference. The first pillar will be the inferential paradigm surrounding the likelihood function of the observations, and the associated maximum likelihood estimator, providing a conceptually unified and in most situations also practical solution to the problem of statistical inference. The distribution of this estimator will be shown to have a universal limiting normal distribution, permitting the use of the estimator for statistical inference. A generalisation of the Gauss-Markov theorem from the linear model can be proved for this estimator, establishing that it is in a certain sense the best among all estimators. Related to the likelihood principle, but in other respects fundamentally different, is the Bayesian approach to statistical inference. This approach, likewise, will be developed for general families of parametric statistical models. The study of the notion of optimality of certain statistical procedures from a general perspective is known as statistical decision theory, of which the main ideas will be presented in the course. The course will also develop the main ideas of some related classical fields in statistics that are crucial in applications, such as inference methods for multivariate data, nonparametric techniques, and resampling (Monte Carlo) procedures.
Requirements: Probability IA and Statistics IB are essential.