

4th NUS Workshop on Risk & Regulation (4th R² Workshop)

7 – 8 January 2016
Singapore



Centre for Quantitative Finance
Faculty of Science



Table of Contents

PROGRAMME

Overview	OV
Daily Schedule	THU - FRI

ABSTRACTS

Invited Talks	1
Contributed Talks	7

INFORMATION

Committee	10
Logistics	
Meals	10
Internet Access & Use of Computers	10
Fax Service	11
Getting Around NUS	11
General	
Public Transportation	12
Getting to the Airport	12
Food & Shopping	13
Bank Services & Foreign Exchange	13
Post Box & Postage Stamps	14
Useful Phone Numbers	14
Zonal Map	15




PROGRAMME
Overview | Daily Schedule

PROGRAMME OVERVIEW

Thursday 7 January 2016	Friday 8 January 2016
08:30 – 08:50 Registration	08:30 – 09:00 Registration
08:50 – 09:00 Opening Address	
09:00 – 09:45 Paul EMBRECHTS	09:00 – 09:45 Halil Mete SONER
09:45 – 10:15 Group Photo & Tea Break	09:45 – 10:15 Tea Break
10:15 – 11:00 David X. LI	10:15 – 11:00 Steven KOU
11:00 – 11:45 Tze Leung LAI	11:00 – 11:45 Harry ZHENG
11:45 – 12:30 Xianhua PENG	11:45 – 12:30 Jingping YANG
12:30 – 14:00 Lunch	12:30 – 14:00 Lunch
14:00 – 14:45 Min DAI	14:00 – 14:45 Bruno BOUCHARD
14:45 – 15:30 Yingda SONG	14:45 – 15:30 Chao ZHOU
15:30 – 16:15 Valérie CHAVEZ-DEMOULIN	15:30 – 16:15 Ningyuan CHEN
16:15 – 16:35 Tea Break	16:15 – 16:25 Closing Address
16:35 – 17:00 (CS1A) Kerstin AWISZUS (CS2A) Seyoung PARK	
17:00 – 17:25 (CS1B) Jingtang MA (CS2B) Cong QIN	
17:25 – 17:50 (CS1C) Yufei YANG (CS2C) Wei JIANG	

 Invited Talks [Lecture Theatre 34, S17 level 3]

 Contributed Talks (Parallel Sessions CS1-CS2) [CS1 in S17 room #04-05, CS2 in S17 room #04-06]

Lecture theatre is equipped with desktop computer connected to LCD projector, projector screen, visualizer, overhead projector, white board, and separate connection for personal notebook or laptop. Microphone will be provided. Seminar rooms are similarly equipped except that visualizer and overhead projector are only available upon prior request. Microphone is not provided.

Thursday, 7 January 2016

TIME	ACTIVITY	VENUE	REF
08:30 – 08:50	Registration	--	--
08:50 – 09:00	Opening Address	LT 34	--
Invited Talks			
09:00 – 09:45	Paul EMBRECHTS ETH Zürich, Switzerland <i>Bernoulli and Tail-Dependence Compatibility</i>	LT 34	Pg 2
09:45 – 10:15	Group Photo & Tea Break	LT 34 foyer	--
10:15 – 11:00	David X. LI AIG Asset Management, United States <i>A Unified Risk-Factor Based Approach to Insurance Company Asset/Liability Management</i>	LT 34	Pg 3
11:00 – 11:45	Tze Leung LAI Stanford University, United States <i>Time-adjusted Evaluation of Default Prediction and Other Probability Forecasts</i>	LT 34	Pg 3
11:45 – 12:30	Xianhua PENG Hong Kong University of Science and Technology, Hong Kong <i>On the Measurement of Economic Tail Risk</i>	LT 34	Pg 4
12:30 – 14:00	Lunch	LT 34 foyer	--
14:00 – 14:45	Min DAI National University of Singapore, Singapore <i>Portfolio Selection with Capital Gains Tax, Recursive Utility, and Regime Switching</i>	LT 34	Pg 2
14:45 – 15:30	Yingda SONG University of Science and Technology of China, China <i>Asset Pricing under Regime Switching Models</i>	LT 34	Pg 5
15:30 – 16:15	Valérie CHAVEZ-DEMOULIN Université de Lausanne, Switzerland <i>Generalized Additive Models for Conditional Dependence Structures</i>	LT 34	Pg 1
16:15 – 16:35	Tea Break	LT 34 foyer	--
Parallel Sessions CS1A & CS2A			
16:35 – 17:00	Kerstin AWISZUS Leibniz Universität Hannover, Germany <i>The Joint Impact of Bankruptcy Costs, Fire Sales and Cross-Holdings on Systemic Risk in Financial Networks</i>	S17-04-05	Pg 7

Thursday, 7 January 2016

TIME	ACTIVITY	VENUE	REF
16:35 – 17:00	Seyoung PARK The Credit Finance Association of Korea, Korea <i>Unemployment Risks and Optimal Retirement in an Incomplete Market</i>	S17-04-06	Pg 8
Parallel Sessions CS1B & CS2B			
17:00 – 17:25	Jingtang MA Southwestern University of Finance and Economics, China <i>Adaptive Algorithms for Static Hedges of General Path-Independent Payoffs</i>	S17-04-05	Pg 8
	Cong QIN National University of Singapore, Singapore <i>Exhaustible Resources with Production Adjustment Costs</i>	S17-04-06	Pg 9
Parallel Sessions CS1C & CS2C			
17:25 – 17:50	Yufei YANG Singapore University of Technology and Design, Singapore <i>Escape from the Black Box: Worst-Case and Sparse Portfolio Selection</i>	S17-04-05	Pg 9
	Wei JIANG National University of Singapore, Singapore <i>Simulating Risk Measures</i>	S17-04-06	Pg 7

Friday, 8 January 2016

TIME	ACTIVITY	VENUE	REF
08:30 – 09:00	Registration	--	--
Invited Talks			
09:00 – 09:45	Halil Mete SONER ETH Zürich, Switzerland <i>Martingale Optimal Transport and Robust Hedging</i>	LT 34	Pg 4
09:45 – 10:15	Tea Break	LT 34 foyer	--
10:15 – 11:00	Steven KOU National University of Singapore, Singapore <i>First Passage Times of Two-Dimensional Brownian Motion</i>	LT 34	Pg 2
11:00 – 11:45	Harry ZHENG Imperial College London, United Kingdom <i>Utility-Deviation Risk Portfolio Selection</i>	LT 34	Pg 6
11:45 – 12:30	Jingping YANG Peking University, China <i>Distorted Mix Method for Constructing Copulas with Tail Dependence</i>	LT 34	Pg 5
12:30 – 14:00	Lunch	LT 34 foyer	--
14:00 – 14:45	Bruno BOUCHARD Université Paris-Dauphine, France <i>Almost-sure Hedging with Permanent Price Impact</i>	LT 34	Pg 1
14:45 – 15:30	Chao ZHOU National University of Singapore, Singapore <i>Stochastic Control for a Class of Nonlinear Kernels and Applications</i>	LT 34	Pg 6
15:30 – 16:15	Ningyuan CHEN Yale University, United States <i>Does the Prohibition of Trade-throughs hurt Liquidity Demanders?</i>	LT 34	Pg 1
16:15 – 16:25	Closing Address	LT 34	--

ABSTRACTS
Invited Talks



Generalized Additive Models for Conditional Dependence Structures **Valérie CHAVEZ-DEMOULIN, Université de Lausanne, Switzerland**

We develop a generalized additive modeling framework for taking into account the effect of predictors on the dependence structure between two variables. We consider dependence or concordance measures that are solely functions of the copula, because they contain no marginal information: rank correlation coefficients or tail-dependence coefficients represent natural choices. We propose a maximum penalized log-likelihood estimator and derive its root-n-consistency and asymptotic normality. Finally, we present the results from a simulation study and apply the new methodology to a real dataset.

Almost-sure Hedging with Permanent Price Impact **Bruno BOUCHARD, Université Paris-Dauphine, France**

We consider a financial model with permanent price impact. Continuous time trading dynamics are derived as the limit of discrete rebalancing policies. We then study the problem of super-hedging a European option. Our main result is the derivation of a non-linear pricing equation. It holds in the sense of viscosity solutions. When it admits a smooth solution, it provides a perfect hedging strategy.

Does the Prohibition of Trade-throughs hurt Liquidity Demanders? **Ningyuan CHEN, Yale University, United States**

We present a model to study the optimal dynamic order execution in a fragmented limit order market with stochastic market depth and general limit order profiles. The result allows us to analyze the impact of prohibiting trade-through on liquidity demanders. We find that a liquidity demander can exploit trade-through to reduce price impact and thus the total execution cost (equivalently, average effective spread). We give examples to illustrate what market conditions motivate trade-through. We show that for small trades and liquid stocks, however, trading through only benefits the investor marginally.

Portfolio Selection with Capital Gains Tax, Recursive Utility, and Regime Switching

Min DAI, National University of Singapore, Singapore

An investor who is subject to capital gains tax has an option to defer taxation of capital gains. To study this deferral option and the optimal strategy, we develop a continuous time portfolio selection model with capital gains tax and Epstein-Zin recursive utility. Our model allows us to use analytical techniques as well as numerical analysis. We also investigate how the coexistence of capital gains tax and a stochastic investment opportunity set affects the investor's behavior.

This is a joint work with Jiayu CAI (Université Paris-Diderot, France) and Xinfu CHEN (University of Pittsburgh, USA).

Bernoulli and Tail-Dependence Compatibility

Paul EMBRECHTS, ETH Zürich, Switzerland

Based on an example from stress testing within a solvency study of an insurance company, in this talk I will present a so-called inverse-dependence problem. In particular, given a symmetric $d \times d$ matrix with $[0,1]$ entries, can this matrix result as the lower (or upper) asymptotic tail-dependence coefficient matrix of a d -dimensional risk vector? A full solution of this problem is given. It is shown that this problem is related to the determination of matrices of second order cross-moments of general Bernoulli vectors.

First Passage Times of Two-Dimensional Brownian Motion

Steven KOU, National University of Singapore, Singapore

First passage times (FPTs) of two-dimensional Brownian motion have seen numerous applications in quantitative finance, such as in studying default correlations under structural models of credit risk, among others. However, despite various attempts since the 1960's, there are few analytical solutions available. By solving a non-homogeneous, modified Helmholtz equation in an infinite wedge, we find analytical solutions for the Laplace transforms of FPTs. We show that these Laplace transforms can be numerically inverted. The FPT problems lead to a class of bivariate exponential distributions which are absolute continuous but do not have memoryless property. We also prove that the density of the absolute difference of FPTs tends to infinity if and only if the correlation between the two Brownian motions is positive.

This is a joint work with Haowen ZHONG.

Time-adjusted Evaluation of Default Prediction and Other Probability Forecasts

Tze Leung LAI, Stanford University, United States

The probability of default and the loss given default for retail and corporate loans are major quantities to forecast in banking regulations. Evaluation of these and other econometric forecasts is a fundamental problem in risk modeling and regulatory analytics. A long-standing issue in this problem is how to model the time series aspects of the data, which consist of pairs of the form (prediction, actual outcome) over time, for statistical inference on the performance measures of the forecasts. We show how martingale theory can be used to address this challenging problem without the need to assume particular time series models for these data. The methodology developed is used to construct confidence intervals for time-adjusted accuracy ratios of default probability forecasts in credit ratings.

This is a joint work with Zhiyu WANG.

A Unified Risk-Factor Based Approach to Insurance Company Asset/Liability Management

David X. LI, AIG Asset Management, United States

Large insurance companies operate in a dynamic and challenging environment today. Traditional insurance business has become a mature business, but faces rapid mutations impacted by technologic evolution, regulatory cross currents, and increasingly lower investment yield environment. At the end, only the fittest, most efficient and most agile will survive, or even prosper. Dealing with each of these challenges in silo without a solid analytic framework and corresponding comprehensive implementation plan is not only futile, but also costly.

This talk attempts to present a unified analytic framework to the insurance company ALM process, including strategic and tactical asset allocation, asset/liability management/macro hedging, economic capital and liability driven performance metrics. This approach is based on risk factors which are fundamental structural drivers to all assets and liabilities on an insurance company balance sheet. The key components of the risk factor based approach are: risk factor identification, risk factor scenario design, valuation, balance sheet construction and the final optimization based on each business application. We will highlight the key issues in each of the above components of the risk factor based approach, and discuss its application in the ALM process.

On the Measurement of Economic Tail Risk

Xianhua PENG, Hong Kong University of Science and Technology, Hong Kong

This paper attempts to provide a decision-theoretic foundation for the measurement of economic tail risk, which is not only closely related to utility theory but also relevant to statistical model uncertainty. The main result is that the only risk measures that satisfy a set of economic axioms for the Choquet expected utility and the statistical property of elicibility (i.e. there exists an objective function such that minimizing the expected objective function yields the risk measure) are the mean functional and the median shortfall, which is the median of tail loss distribution. We discuss the relationship of elicibility and co-elicibility and their implication on backtesting. We also extend the result to address model uncertainty by incorporating multiple scenarios. As an application, we argue that median shortfall is a better alternative than expected shortfall for setting capital requirements in Basel Accords.

This is a joint work with Steven Kou (National University of Singapore, Singapore).

Martingale Optimal Transport and Robust Hedging

Halil Mete SONER, ETH Zürich, Switzerland

The original transport problem is to optimally move a pile of soil to an excavation. Mathematically, given two measures of equal mass, we look for an optimal map that takes one measure to the other one and also minimizes a given cost functional. Kantorovich relaxed this problem by considering a measure whose marginals agree with given two measures instead of a bijection. This generalization linearizes the problem. Hence, allows for an easy existence result and enables one to identify its convex dual.

In robust hedging problems, we are also given two measures. Namely, the initial and the final distributions of a stock process. We then construct an optimal connection. In general, however, the cost functional depends on the whole path of this connection and not simply on the final value. Hence, one needs to consider processes instead of simply the transport maps. The probability distribution of this process has prescribed marginals at final and initial times. Thus, it is in direct analogy with the Kantorovich measure. But, financial considerations restrict the process to be a martingale. Interestingly, the dual also has a financial interpretation as a robust hedging (super-replication) problem.

In this talk, we prove an analogue of Kantorovich duality: the minimal super-replication cost in the robust setting is given as the supremum of the expectations of the contingent claim over all martingale measures with a given marginal at the maturity.

This is a joint work with Yan DOLINSKY (Hebrew University, Israel).

Asset Pricing under Regime Switching Models

Yingda SONG, University of Science and Technology of China, China

Regime switching models are widely used in finance to incorporate the random market environment. In this paper, we provide a unified framework for a range of valuation problems under a general class of regime switching models. Applications include path-dependent options and term structure model of interest rates. Numerical results indicate that our method is accurate and efficient.

This is a joint work with Ning CAI and Steven KOU.

Distorted Mix Method for Constructing Copulas with Tail Dependence

Jingping YANG, Peking University, China

We will introduce a method for constructing copula functions by combining the ideas of distortion and convex sum, named Distorted Mix Method. The method mixes different copulas with distorted margins to construct new copula functions, and it enables us to model the dependence structure of risks by handling central and tail parts separately. By applying the method we can modify the tail dependence of a given copula to any desired level measured by tail dependence function and tail dependence coefficients of marginal distributions. As an application, a tight bound for asymptotic Value-at-Risk of order statistics is obtained by using the method. An empirical study shows that copulas constructed by this method fit the empirical data of SPX 500 Index and FTSE 100 Index very well in both central and tail parts.

This is a joint work with Lujun Li and K. C. Yuen.

Utility-Deviation Risk Portfolio Selection

Harry ZHENG, Imperial College London, United Kingdom

In this talk we discuss a utility-deviation risk portfolio selection problem. By considering the first order condition for the objective function, we derive a primitive static problem, called Nonlinear Moment Problem, subject to a set of constraints involving nonlinear functions of “mean-field terms”, to completely characterize the optimal terminal wealth. Under a mild assumption on utility, we establish the existence of the optimal solutions for both utility-downside-risk and utility-strictly-convex-risk problems, their positive answers have long been missing in the literature. In particular, the existence result in utility-downside-risk problem is in contrast with that of mean-downside-risk problem considered in Jin-Yan-Zhou (2005) in which they prove the non-existence of optimal solution instead and we can show the same non-existence result via the corresponding Nonlinear Moment Problem.

This is a joint work with K.C. Wong (University of Hong Kong and Imperial College) and S.C.P. Yam (Chinese University of Hong Kong).

Stochastic Control for a Class of Nonlinear Kernels and Applications

Chao ZHOU, National University of Singapore, Singapore

A stochastic control problem for a class of nonlinear stochastic kernels is studied. We prove a dynamic programming principle (DPP) for the value function by a measurable selection argument and consider several applications of the DPP.

This is a joint work with Dylan POSSAMAI and Xiaolu TAN.

ABSTRACTS
Contributed Talks



The Joint Impact of Bankruptcy Costs, Fire Sales and Cross-Holdings on Systemic Risk in Financial Networks

Kerstin AWISZUS, Leibniz Universität Hannover, Germany

The paper presents a comprehensive model of a banking system that integrates network effects, bankruptcy costs, fire sales, and cross-holdings. For the integrated financial market we prove the existence of a price-payment equilibrium and design an algorithm for the computation of the greatest and the least equilibrium. Systemic risk measures and the number of defaults corresponding to the greatest price-payment equilibrium are analyzed in several comparative case studies. These illustrate the individual and joint impact of interbank liabilities, bankruptcy costs, fire sales and cross-holdings on systemic risk.

This is a joint work with Stefan WEBER (Leibniz Universität Hannover, Germany).

Simulating Risk Measures

Wei JIANG, National University of Singapore, Singapore

Risk measures, such as value-at-risk and expected shortfall, are widely used in risk management, as exemplified in the Basel Accords proposed by Bank for International Settlements. We propose a simple general framework, allowing dependent samples, to compute these risk measures via simulation. The framework consists of two steps: In the C-step, we control the relative errors in the simulation by computing the necessary sample size needed for simulation, using a newly derived asymptotic expansion of the relative errors for depend samples; in the S-step, the risk measures are computed by using sorting algorithms. Numerical experiments indicate that the algorithm is easy to implement and fast, compared to existing methods, even at the 0.001 quantile level. We also give a comparison of the relative errors of value-at-risk and expected shortfall.

This is a joint work with Steven KOU (National University of Singapore, Singapore).

Adaptive Algorithms for Static Hedges of General Path-Independent Payoffs

Jingtang MA, Southwestern University of Finance and Economics, China

In this talk we present a new algorithm to find the optimal static replicating portfolios for general path-independent nonlinear payoff functions and give an estimate for the rate of convergence that is absent in the literature. We choose the static replication by designing an adaptation function arising in the error bound between the nonlinear payoff function and the piecewise linear polynomial approximation and derive the equidistribution equation for selecting the optimal strikes. The numerical tests for variance swaps, swaptions, static quadratic hedges, and also for a jump diffusion process allowing for the default of the underlying asset, show that the proposed iterative equidistribution equation algorithm is simple, fast and accurate.

This is joint work with Dongya DENG (Southwestern University of Finance and Economics, China) and Harry ZHENG (Imperial College, London).

Unemployment Risks and Optimal Retirement in an Incomplete Market

Seyoung PARK, The Credit Finance Association of Korea, Korea

We develop a new approach for solving the optimal retirement problem for an individual with an unhedgeable income risk. The income risk stems from a forced unemployment event, which occurs as an exponentially-distributed random shock. The optimal retirement problem is to determine the individual's optimal consumption and investment behaviors and optimal retirement time simultaneously. We introduce a new convex-duality approach for reformulating the original retirement problem and provide an iterative numerical method to solve it. Reasonably calibrated parameters say that our model can give an explanation for lower consumption and risky investment behaviors of individuals and a relatively higher stock holdings for the poor. We also analyze the sensitivity of an individual's optimal behavior in changing her wealth level, investment opportunity, and the magnitude of preference for post-retirement leisure. Finally, we find that our model explains a counter-cyclical pattern of the number of unemployed job leavers.

This is a joint work with Alain BENSOUSSAN (City University of Hong Kong & The University of Texas at Dallas, Hong Kong & United States) and Bong-Gyu JANG (POSTECH, Korea).

Exhaustible Resources with Production Adjustment Costs **Cong QIN, National University of Singapore, Singapore**

We develop a general equilibrium model of exhaustible resources with production adjustment costs and show that Hotelling's rule does not hold even without extraction costs. Our model is not only more analytically tractable than earlier ones with adjustment costs but also, by incorporating demand uncertainty, predicts some empirical phenomena observed in real markets that there are periods during which the forward prices are either backwardated or in contango, that a non-monotonic term structure of volatility, and that the V-shape relation between volatility of forward prices and slope of forward curves. In addition, our model demonstrates that adjustment costs can significantly prolong the period of low price in the case of either low demand level or large new discoveries of reserve due to exploration.

This is a joint work with Min DAI (National University of Singapore, Singapore) and Steven KOU (National University of Singapore, Singapore).

Escape from the Black Box: Worst-Case and Sparse Portfolio Selection **Yufei YANG, Singapore University of Technology and Design, Singapore**

A well-managed portfolio is vital for an investor's success. Stability to parameter uncertainty and sparsity are two common criteria used to assess portfolio weights. In practice, parameter uncertainty could be effectively alleviated by diversification or utilizing the robust optimization techniques. However, sparsity is desired when an investor tends to hold only a limited number of assets, since it is too cumbersome to take all assets into account. These two criteria are seemingly different, but both related to the notion of robustness, one from the worst-case feasibility perspective and the other from the ease of management. We are particularly interested to understand how the trade-off between these two criteria affect the portfolio weights. Based on Markowitz mean-variance framework, we propose a stylized model that incorporates an ellipsoidal uncertainty set and fixed transaction costs. In addition to tractability, we focus on the interpretability power of the model by illustrating that the optimal portfolio could be decomposed as a weighted average of two benchmark portfolios, i.e., Markowitz mean-variance portfolio and minimum variance portfolio, plus a correction term. Portfolio managers could use our analytical formulae to build their holdings with prescribed stability and sparsity guarantees, instead of regarding portfolio selection as a "black-box" process.

This is a joint work with Selin Damla AHIPASAOGLU (Singapore University of Technology and Design, Singapore) and Jingnan CHEN (Singapore University of Technology and Design, Singapore).

INFORMATION

Committee | Logistics | General | Zonal Map



Committee

ORGANIZING COMMITTEE

Min DAI (National University of Singapore, Singapore)

Steven KOU (National University of Singapore, Singapore)

Logistics

MEALS

Tea breaks and lunches, served buffet-style at the event venue, are catered from a Halal-certified supplier. Usually some of the food items would be suitable for vegetarians.

Dinners are not included. Nevertheless, a wide variety of food at affordable prices (from S\$2.00) is available in the non-air-conditioned canteen and air-conditioned cafe near the venue for talks. More canteens, fast food outlets and restaurants are found in other parts of the campus (refer to Zonal Map). Some are less than 10-minutes' walk away from the event venue while some are accessible by internal shuttle bus. Some stalls may open as early as 7.30am and close as late as 8.00pm. Halal and Vegetarian options are available in all canteens on campus.

INTERNET ACCESS & USE OF COMPUTERS

A computing lab (S17-03-02) will be open for participants' access during the event period. It is located at level 3 of block S17 and consists of 42 desktop units that are internet-ready and installed with Windows 7, standard Microsoft Office applications, SSH, Adobe Reader, and MATLAB. Limited WI-FI accounts would also be made available during event period for the convenience of those using personal notebook/laptop.

Operating hours: 8.30am – 6.00pm (Monday – Thursday)
 8.30am – 5.30pm (Friday)

Participants will have to request for account name and password to use either the computer in the computing lab, or for WI-FI access on their own notebook/laptop. Approach the IT support staff for account name and password (subject to availability).

FAX SERVICE

Participants who wish to send faxes may do so at the general office of the Department of Mathematics (level 4, block S17). This service is chargeable at a flat rate of S\$0.50 per page.

Operating hours: 8.30am – 6.00pm (Monday – Thursday)

Operating hours: 8.30am – 5.30pm (Friday)

GETTING AROUND NUS

The internal shuttle buses A, B, C, D, and UT-FoS (free-of-charge) serve the Kent Ridge campus.

Bus A1 and A2 cover substantial parts of the campus. A1 stops outside Kent Ridge MRT station, NUH and opposite S17, while A2 stops outside S17, opposite NUH and opposite Kent Ridge MRT station.

Bus A1E and A2E operates during term time on weekdays except public holidays. Bus A1E operates from 7.30am to 9.00am and stops outside Kent Ridge MRT station, and opposite S17. Bus A2E operates from 5.30pm to 7.00pm and stops outside S17, and opposite Kent Ridge MRT station.

Bus B is a loop service that serves Kent Vale and the other part of the campus. It does not stop at or anywhere near S17.

Bus C is a loop service that serves Kent Vale. It stops in front of and opposite S17.

Bus D is a loop service that serves the University Town. Bus D1 does not stop at or anywhere near S17. Bus D2 stops outside Kent Ridge MRT, opposite S17, University Town, outside S17 and opposite Kent Ridge MRT.

Bus UT-FoS is a direct service provided during term time on weekdays except public holiday at 9.40am, 9.50am, 11.40am, 11.50am, 1.40pm, 1.50pm, 3.40pm, and 3.50pm. Bus UT-FoS stops only at University Town and opposite S17.

More details on NUS internal shuttle bus can be found at:

<http://www.nus.edu.sg/oed/services/transport/shuttle-bus-services.htm>

The public bus SBS95 (fare-based) stops at the same stops as A1 and A2 between S17 and Kent Ridge MRT station. It also stops near and opposite Buona Vista MRT station (which is off-campus).

General

PUBLIC TRANSPORTATION

The public transport network in Singapore consists of bus, MRT (Mass Rapid Transit), LRT (Light Rail Transit) and taxi. Buses and MRTs are the most affordable modes of public transport with standard fares ranging from S\$1.00 to S\$3.00 (depending on distance). Bus fares are charged on board by tapping a stored-value card or paying the exact fare in Singapore currency to the driver. Bus and MRT fares can be calculated using the Fare Calculator on the Public Transport website (<http://www.publictransport.sg>).

MRT fare is paid by tapping a Stored Value Smartcard or a Standard Ticket at the gantry. The Standard Ticket can be used up to six times within 30 days from the date of purchase. The purchase price includes a deposit of 10 cents which will be automatically returned through an off-set against the passenger's fare on the third trip. A user also enjoys a 10-cent discount on the sixth trip. The Standard Ticket can be purchased at the General Ticketing Machine (GTM) at all MRT and LRT stations. LRTs are only available in selected residential neighbourhoods and operate similarly as MRTs.

Typically, the first bus and train starts running at 5.30am and the last service is 11.30pm daily. Special night bus services, NightRider (NR), with specific routes charge a flat rate of S\$4.50 per trip are available from 11.30pm to 2.00am on Fridays, Saturdays and eves of Public Holidays.

Taxis can be flagged down 24 hours a day on most roads or at taxi-stands outside most major shopping centres and hotels. There is no need to bargain for prices as the taxis are all metered. The basic fare consists of a flag-down fare and a metered fare. The flag-down fare for the first kilometer or less is between S\$3.00 and S\$5.00, depending on the type of taxi (regular or premium). The metered fare after the first kilometer is based on the distance and waiting times during the journey. Additional charges may also be incurred depending on the time of travel and origin of the journey. A detailed rates guide is posted on the rear door of each taxi for reference.

GETTING TO THE AIRPORT

The easiest way to get to the airport is by taxi. For reference, the journey from NUS with smooth traffic would take about 30 minutes and cost about S\$25.00 without surcharge. Surcharges may be incurred depending on time of travel and if the taxi was pre-booked.

To get to the airport by MRT (Mass Rapid Transit), connect to the East-West line (green line) going in the direction of Pasir Ris/Changi Airport. The Changi Airport MRT station is located under Terminals 2 and 3 which are connected to Terminal 1 by sky train. A one-way MRT fare from Kent Ridge station is about S\$2.60 (using the Standard Ticket) and takes approximately 54 minutes. Actual travel times may be affected by transfers, waiting times, train system faults and peak/non-peak hour carriage frequencies. More information on MRT Network Map and fare can be found at: <http://journey.smrt.com.sg/>

FOOD & SHOPPING

Food centres and food courts serving local, Asian and sometimes international cuisine at affordable prices are commonly found in neighbourhoods and shopping malls. There would usually be at least one each of Halal and vegetarian stalls in most establishments. Operating hours of the stalls vary but most of them open by 10am and close by 9pm.

Cafes and Restaurants are usually found in shopping malls and bigger neighbourhoods. Operating hours depend on the types of meals served but most would be open between 11.00am and 9.00pm.

Most shopping malls in Singapore operate from 11.00am to 10.00pm every day.

BANK SERVICES & FOREIGN EXCHANGE

Participants may use major credit cards to withdraw cash using the Auto Teller Machines (ATM), which can be found in various locations on campus. Alternatively, the local banks offer regular banking services including processing foreign exchange and traveler's cheques. The nearest branches are:

DBS (Holland Village Branch)

Address: 257 Holland Avenue, Singapore 278984

Tel: 1800 111 1111

Operating hours: 8.30am - 4.30pm (Monday – Friday)
8.30am - 1.00pm (Saturday)

DBS/POSB (NUS Remix Branch)

Address: 31 Lower Kent Ridge Road, #01-02 Yusof Ishak House, Singapore 119078

Tel: 1800 111 1111

Operating hours: 8.30 AM - 4.30 PM (Monday – Friday)
8.30 AM - 1.00 PM (Saturday)

Only Personal Banking Services are available. Demand Draft and Remittance services are not available. All cash transactions must be made at Automated Teller Machines.

DBS (Clementi Branch)

Address: Blk 450 Clementi Avenue 3 #01-293/295, Singapore 120450

Tel: 1800 111 1111

Operating hours: 8.30am - 4.30pm (Monday – Friday)
8.30am - 1.00pm (Saturday)

UOB (Holland Village Branch)

Address: 211 Holland Avenue, #01-12 Holland Road Shopping Centre, Singapore 278967

Tel: 1800 222 2121

Operating hours: 9.30am - 4.00pm (Monday – Friday)
9.00am - 12.30pm (Saturday)

POST BOX & POSTAGE STAMPS

Postage stamps can be purchased at the NUS Coop store below Lecture Theatre 27. Other goods and services available at the co-op include books, stationery, sundries and photocopying.

Operating hours (co-op): 9.00am – 6.00pm (Monday – Friday)

A post box is stationed near the bus stop in front of Block S17.

USEFUL PHONE NUMBERS

Taxi (for current and advanced booking):

<u>Company</u>	<u>Telephone</u>	<u>Colour of vehicle</u>
CityCab	65521111	Yellow
Comfort Taxi	65521111	Blue
Premier Taxis	63636888	Silver
Prime Taxis	67780808	Copper (regular service); Blue (limousine service)
SMRT Taxis	65558888	White
Trans Cab	65553333	Red
Yellow Top Taxis	62935545	Yellow top with black body

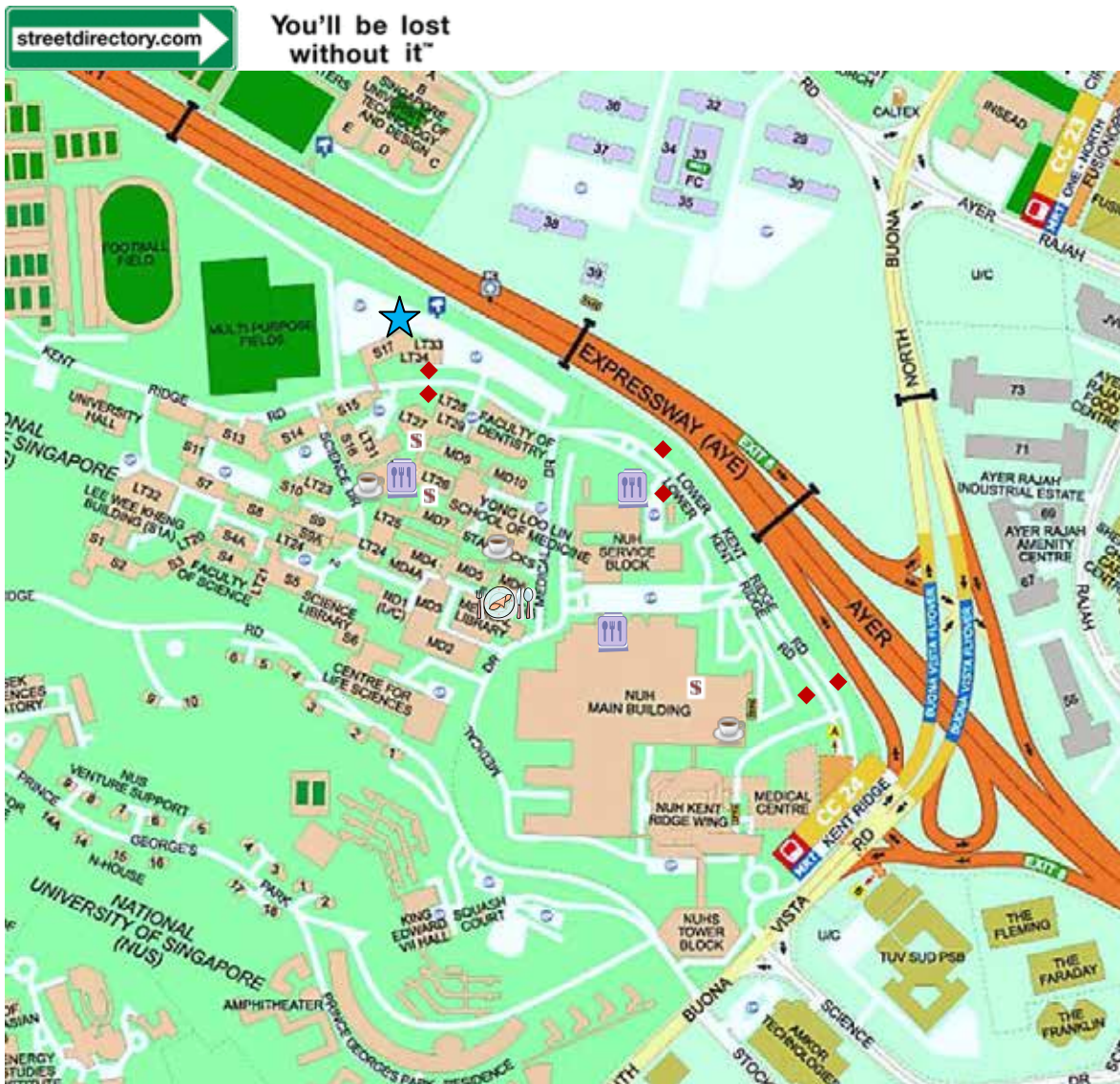
Local Emergency Services for Credit Cards:

American Express	1800-299-1997
Diner's Club Singapore	64160800(during office hours); 64160900 (after office hours)
MasterCard	800-1100-113
Visa	800-4481-250
JCB	001-800-3865-5486







Others:

Tourist Information (Singapore Tourism Board)	1800-7362000
24-hour Flight Inquiry (Changi Airport)	1800-5424422
Buona Vista Neighbourhood Police Post	1800-7779999
Police Emergency	999
Non-emergency Ambulance	1777
Fire Engine/Ambulance	995

Zonal Map



Map powered by Streetdirectory.com

-  Workshop venue (S17)
-  Bus-stop
-  Canteen/Food Court
-  Restaurant
-  Coffee joints (Platypus at Science Canteen; Spinelli at Science canteen; The Coffee Bean at NUH; Starbucks at School of Medicine)
-  Auto Teller Machine