UNIVERSITI TEKNOLOGI MARA

ASC550: SURVIVAL MODELS

Course Name (English)	SURVIVAL MODELS APPROVED
Course Code	ASC550
MQF Credit	4
Course Description	The course provides students with a grounding on the fundamentals and application of survival models and their analysis. Part of this course follows the syllabus of Core Statistics 2 (CS2) from Institute and Faculty of Actuaries (IFoA). [Unit,4]The course provides students with a grounding on the fundamentals and application of survival models and their analysis. Part of this course follows the syllabus of Core Statistics 2 (CS2) from Institute and Faculty of Actuaries (IFoA). [Unit,4]
Transferable Skills	Demonstrate professional skills, knowledge and competencies.
Teaching Methodologies	Lectures, Tutorial
CLO	CLO1 Describe techniques of survival analysis to actuarial related problems CLO2 Apply techniques of survival analysis to solve actuarial problems CLO3 Demonstrate lifelong learning skills in project assignments related to survival models
Pre-Requisite Courses	No course recommendations

Topics
1. The Life Tables 1.1) The Traditional Form of the Life Table 1.2) Other Functions derived from l_x 1.3) Expected value and variance future lifetime 1.4) Methods for Non-Integral Ages 1.5) Simple parametric survival models- Parametric Survival
2. Estimating the Lifetime Distribution Function 2.1) Data censoring mechanisms 2.2) Kaplan Meier (product limit) model estimation 2.3) Nelson Aalen model estimation 2.4) Parametric estimation of the survival function using maximum likelihood estimates
3. Proportional Hazard Models 3.1) Forms of Proportional Hazard model 3.2) Cox Proportional Hazards model 3.3) Estimating the regression parameter
4. Maximum Likelihood Estimation for transition intensities 4.1) Observational plan in respect of a finite number of individuals observed during a finite period of time, and define the resulting statistics, including the waiting times. 4.2) Derivation of likelihood function and maximum likelihood estimation for transition intensities in Markov model
5. Exposed to Risk 5.1) Calculating the exposed to risk 5.2) Central exposed to risk versus initial exposed to risk 5.3) Problems and solutions to heterogeneity of mortality investigation 5.4) Principle of correspondence and its importance in the estimation procedure 5.5) Exact calculation of Central exposed to risk 5.6) Census approximation to central exposed to risk 5.7) Death classified under different definitions of age 5.8) Consistency between census data (population data) and death data in estimating exposed to risk

6. Graduation and Statistical Test 6.1) Graduation of observed mortality 6.2) Simulation process for time-homogeneous and inhomogeneous Markov Jump process 6.3) Limitations of graduation 6.4) Desirable features of graduation 6.5) Comparison with standard table 6.6) Testing the smoothness of graduation 6.7) Statistical test for crude estimates
7. Graduation and Statistical Test 7.1) Graduation by parametric formula 7.2) Graduation by reference to standard table 7.3) Graphical graduation 7.4) Comparison between different graduation methods 7.5) Effect of duplicate policies
8. Mortality Projection 8.1) Describe approaches to the forecasting of future mortality rates based on extrapolation, explanation and expectation, and their advantages and disadvantages. 8.2) Describe the Lee-Carter, age-period-cohort, and p-spline regression models for forecasting mortality. This includes main sources of error for mortality forecasting

Assessment Breakdown	%
Continuous Assessment	30.00%
Final Assessment	70.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	CLO3 -10%	10%	CLO3
Test	CLO2 -10%	10%	CLO2
Test	CLO1 -10%	10%	CLO1

Reading List

Recommended Text

- **Institute and Faculty of Actuaries 2019, *Core Reading for CS2 Actuarial Statistics***
- **Kris Bogaerts,Arnost Komarek,Emmanuel Lesaffre 2016, *Survival Analysis with Interval-Censored Data*, Chapman and Hall/CRC [ISBN: 9781420077476]**
- **Moore, Dirk F. 2016, *Applied Survival Analysis Using R*, 2 Ed., Springer [ISBN: 9783319312]**
- **London, D. 1997, *Survival Models and Their estimation* , 2 Ed., , ACTEX Publication [ISBN:]**
- **David, C., Dickson, M., Hardy, M.R. & Waters, 2009, *Actuarial Mathematics for Life Contingent Ris*, Cambridge University Press.**
- **2020, *Actuarial mathematics for life contingent risks.*, Cambridge University Press [ISBN: 978108478083]**

Reference Book Resources

- **Bowers, N.L. 1997, *Actuarial Mathematics, The Society of Actuari*, Ed., , [ISBN:]**
- **Regina, C. & Johnson, N.L. 1999, *Survival Models and Data Analysis*, Ed., , Wiley Classic Library [ISBN:]**

Article/Paper List

Recommended Article/Paper Resources

- **Thomas R. Vetter 2018, Survival Analysis and Interpretation of Time-to-Event Data: The Tortoise and the Hare, *International Anaesthesia Research Society*, 792-7**

Other References

This Course does not have any other resources