INTEGRATION OF INTERVAL TYPE-2 FUZZY SAW AND INTERVAL TYPE-2 FUZZY TOPSIS FOR AMBULANCE LOCATION SELECTION

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APPROVAL

I certify that an Examination Committee has met on 12th April 2015 to conduct the final examination of C. W. Rabiatul Adawiyah C. W. Kamal, on her Master of Science thesis entitled "Integration of Interval Type-2 Fuzzy SAW and Interval Type-2Fuzzy TOPSIS for Ambulance Location Selection" in accordance with the regulations approved by the Senate of Universiti Malaysia Terengganu. The Committee recommends that the candidate be awarded the relevant degree. The members of the Examination Committee are as follows:

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Abstract of thesis presented to the Senate of Universiti Malaysia Terengganu in fulfillment of the requirement for the degree of Master of Science

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C.W. RABIATUL ADAWIYAH C.W. KAMAL

APRIL 2015

Main Supervisor: ProfessorMohdLazim Abdullah, Ph.D.

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Nowadays, Multi Criteria Decision Making (MCDM) methods are widely utilized and known as effective tools in solving real world problems. Various MCDM methods have been implemented in solving diverse applications of decision problems. One of the MCDM methods is additive weighting-based method. Unfortunately, this method is not always applicable due to the limitations in computational reliability and its applications are not-well received by many MCDM enthusiasts. The method is extended to Fuzzy Simple Additive Weighting (Fuzzy SAW)thanks to the development of fuzzy set theory. Fuzzy SAW utilized fuzzy numbers rather than crisp numbers.Nevertheless, type-1 fuzzy set is weak in handling uncertainty compared to Interval Type-2 Fuzzy Set (IT2 FS).Differently from the typical Fuzzy SAW, which directly utilized trapezoidal type-1 fuzzy numbers, IT2 FS introducedto the Fuzzy SAW to enhance judgments in the fuzzy decision making environment.IT2 FS is more sensitive in handling uncertain information or data.Besides, in this study, Interval Type-2 Fuzzy Simple Additive

Weighting (IT2 Fuzzy SAW) method is integrate with Interval Type-2 Fuzzy Technique for Order Preference by Similarity to Ideal Solution (IT2 Fuzzy TOPSIS) method to handle fuzzy multiple criteria decision making problems based on IT2 FSs. IT2 Fuzzy SAW is utilized in determining the weight for each criterion, and IT2 Fuzzy TOPSIS method is operated to obtain final ranking for alternatives. In order to examine the effectiveness of the proposed methods, the methods were implemented in a case study of ambulance location selection.The results of the case study using proposed methods show inconsistency in the preference orders either in IT2 Fuzzy SAW or Integrated IT2 Fuzzy SAW and IT2 Fuzzy TOPSIS. Obviously the final evaluation of alternatives for the four methods (Fuzzy SAW, IT2 Fuzzy TOPSIS, IT2 Fuzzy SAW and Integrated IT2 Fuzzy SAW and IT2 Fuzzy TOPSIS) shows road network as the best alternative for ambulance placement.Therefore, road network is recommended as a strategic location for ambulance placement. It is shown that the usage of IT2 FS and IT2 Fuzzy TOPSIS gives a large impact to the ranking order. Significantly, the proposed methods provide more flexibility and objective information in dealing with MCDM problems in a fuzzy environment.

Abstrak thesis yang dikemukankepadaSenatUniversiti Malaysia Terengganu sebagaimemenuhikeperluanuntukijazah Master Sains

PEMADUAN SAW KABUR SELANG JENIS-2 DAN TOPSIS KABUR SELANG JENIS-2 UNTUK PEMILIHAN KEDUDUKAN AMBULANS

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PusatPengajian :InformatikdanMatematikGunaan

Padamasakini, kaedahPembuatanKeputusanPelbagaiKriteria (MCDM)digunakansecarameluasdandikenalisebagaialat yang berkesanuntukmenyelesaikanmasalahduniasebenar.Pelbagaikaedah MCDM telahdilaksanakandalammenyelesaikanpelbagaiaplikasimasalahmembuatkeputusan. Salah satukaedah MCDM ialahkaedah yang berasaskanpemberattambahan.Malangnya, kaedahinitidakselalunyadapatdigunakankeranaketerbatasandalamkebolehpercayaanpengiraandanaplikasinyatidakditerimabaikolehkebanyakanpengemar MCDM.KaedahinidilanjutkankepadaPemberatTambahanKaburMudah (SAWKabur) terimakasihterhadappembangunanteori set kabur. SAW Kaburmenggunakannomborkaburdanbukannyanomborrapuh. Namunbegitu, set kabur jenis-1 adalahlemahdalammenanganiketidaktentuanberbandingdengan Set KaburSelang Jenis-2 (IT2 FS).Berlainandari SAW Kaburbiasa, yang manasecaralangsungmenggunakannomborkabur trapezoidal jenis-1, IT2 FS

diperkenalkankepada SAW Kaburuntukmeningkatkanpenghakimandalampersekitarankaburmembuatkeputusan.IT2 FS adalahlebihsensitifdalammengendalikanmatlumatatau data yang tidakmenentu.Selainitu, dalamkajianini, kaedah SAW KaburSelang Jenis-2 (IT2 Kabur SAW) dipadukandengankaedah TOPSIS KaburSelang Jenis-2 (IT2 Kabur TOPSIS) untukmengendalimasalahkaburpelbagaikriteriamembuatkeputusanberdasarkan IT2 FS.IT2 Kabur SAW digunakandalammenentukanberatuntuksetiapkriteriadankaedah IT2 Kabur TOPSIS dikendalikanuntukmendapatkankedudukanakhiralternatif.Dalamusahauntukmenyelidikkeberkesanankaedah yang dicadangkan, kaedahtersebuttelahdilaksanakandalamkajiankespemilihanlokasiambulans.Keputusan kajiankesmenggunakankaedah yang dicadangmenunjukkanketidakselarasandalamperintahkeutamaansamaadadalam IT2 Kabur SAW ataupemaduan IT2 Kabur SAW dan IT2 Kabur TOPSIS.Secarajelas, penilaianakhiralternatifuntukempatkaedah (SAW Kabur, IT2 Kabur TOPSIS, IT2 Kabur SAWdanPaduan IT2 Kabur SAW dan IT2 Kabur TOPSIS) menunjukkanrangkaianjalanrayasebagaialternatifterbaikuntukpenempatanambulans. Olehitu, rangkaianjalanrayadisarankansebagailokasi yang strategikuntukpenempatanambulans.Iamenunjukkanbahawapenggunaan IT2 FS dan IT2 Kabur TOPSIS memberiimpak yang besarkepadaperintahkedudukan.Nyatasekalikaedah yang dicadangkanmemberilebihbanyakfleksibilitidanmaklumat yang objektifdalammenanganimasalah MCDM dalampersekitaran yang kabur.