# ABSTRACT

This thesis presents a new step-down dependent bootstrap min P procedure. By using the closure principle to adjust a p-value of the complete null hypothesis, the new procedure is being compared with the traditional step-down bootstrap min P and Dunnett's *t* statistic. The conditions of this study are (1) There are 3 treatment groups and 1 control group (2) Each group has equal sample size (3) The sample size (*r*) is 3, 4, 5, …, 10 and (4) The error term is normally distributed with equal variance. The significance level $\alpha$ of the two-sided test is set at 0.05. Furthermore, the number of copies (*c*) of the sample data for the dependent bootstrap is being investigated at 2 or 4 copies while the number of bootstrap resamples equals 100, 1,000 or 10,000. Monte Carlo simulation with 1,000 repetitions is currently a realization. The criteria for efficiency comparisons of each procedure is determined by pre-specified and acceptable level $\alpha$ for the Type I error rate and seeking the test that should produce maximum power within the class of tests with Type I error rate at most $\alpha$ .To obtain the empirical Type I error rate of each procedure, we have generated the sample data from a $N(100, 25)$ population for each treatment group. Empirical power of the test is obtained by generating the sample data from a $N(60, 25)$ population for a control group and from a $N(100, 25)$ population for the other treatment groups.

Simulation results show that the empirical Type I error rates of all procedures lie between 0.036 to 0.064 when the nominal alpha is set at 0.05 or all procedures are able to control Type I error rate at the significance level 0.05. When the small number of bootstrap resamples equals to 100 or 1,000, Dunnett's *t* statistic has higher empirical power than step-down procedures in most conditions of the simulation. When the number of bootstrap resamples is equal to 10,000, the step-down dependent bootstrap min P provides the highest empirical power of the test in almost all conditions of the simulation. The step-down dependent bootstrap min P is not worse than the other two procedures for almost all conditions of the simulation, and the empirical power of all of the procedures increases significantly with increasing sample

size. However, the results of the simulation show that neither the number of bootstrap resamples (*B*) nor the number of copy sample data (*c*) does not obviously affects the empirical power of the test in all conditions.