Malaysian Journal of Library & Information Science, Vol.13, no.2, Dec 2008: 15-28

DIFFERENCE AMONG RANKING ALGORITHMS OF DIFFERENT WEB SEARCH TOOLS: A STATISTICAL APPROACH

Alireza Isfandyari-Moghaddam[1] and **Vahid Ranjbar**[2]
[1]Department of Library and Information Studies,
Islamic Azad University, Hamedan Branch, Iran;
[2]Department of Statistics, Faculty of Mathematical Sciences,
Ferdowsi University of Mashhad, Iran
e-mail: ali.isfandyari@gmail.com

Abstract
One of evaluation studies examining web search tools is ranking algorithm area. Accepting the idea that different search tools do use different ranking algorithms, the present research aims to confirm such an idea using a statistical approach. To do this, five metasearch engines (MSEs) namely Ez2find, Dogpile, MetaCrawler, Info and WebCrawler along with their four common underlying single search engines (SEs) – Google, Yahoo!, Msn (currently called Windows Live Search) and Ask – have been applied. To conduct the research five queries have been utilized. For comparing ranking algorithms of these web search tools, statistical tests "Kruskal-Wallis" and "Tukey HSD" were utilized. The findings indicate and confirm that different search tools on the web make use of different ranking algorithms. In other words, this research supports findings of previous studies.

Keywords Ranking algorithm; Search engines; Metasearch engines; Web searching; Internet studies

INTRODUCTION

The web is treated as one of the most frequently used sources for public as well as scholarly information gathering. Information sources available through the web are regularly being referenced in scientific publications (Bar-Ilan 2005). It is worth saying that web searching is the most popular online activity, behind email (Spink et al. 2006). However, after about 16 years of work, web searching area is apparently in its childhood and mechanisms relating to this will continue to grow and evolve.

The primary tools for accessing needed information on the web are the search tools including Search engines (SEs), directories and Metasearch engines (MSEs). These tools compete with each other for attracting users. Yet, evaluation studies play an important role in making such information-finding facilities familiar for searchers and other users. On the basis of Jansen and Molina (2006) one can group evaluation studies or metrics assessing search tools into categories of relevance evaluations, ranking and stability of links. Focus of this study is the second namely ranking, or to be precise, ranking algorithm.

According to Bar-Ilan, Mat-Hassan and Leverne (2006), *"in classical IR (information retrieval) systems results ranking was based mainly on term frequency and inverse document frequency. Web search results ranking algorithms take into account additional parameters such as the number of links pointing to the given page, the anchor text of the links pointing to the page, the placement of the search terms in the document (terms occurring in the title or header may get a higher weight), the distance between the search terms, popularity of the page (in terms of the number of times it is visited), the text appearing in meta-tags, subject-specific authority of the page, recency in search index, and exactness of match"*.

Nevertheless, the ranking algorithms of the search tools are opaque (Spink, Greidorf and Bateman 1998; Ellis, Ford and Furner 1998; quoted in Fattahi, Wilson and Cole 2008). According to them, *"often with inadequate explanation of how queries are interpreted by the SEs"*. They are, on the one hand, trade secrets, and on the other hand, the search tools fear that web sites owners will misuse the available information in order to gain higher rankings for their pages (Bar-Ilan 2005). For example, Google, as the most popular search tools (Brooks 2004) declares:

"Due to the nature of our business and our interest in protecting the integrity of our search results, this is the only information we make available to the public about our ranking system".

In addition, this procedure seems true in MSEs. For instance, Mamma.com (2007) uses a voting system for ranking results, whereas Ixquick has a star (asterisk) system[1]. According to this system, an Ixquick result is awarded one star (★) for every SE that chooses it as one of the ten best results for your search. So, a five star (★★★★★) result means that five search engines agreed on the result. In relation to the system applied by Ixquick, Margolis (2006) declares that Ixquick combines the relevancy ranking of a variety of search engines to generate a "star" rating that ensures a degree of relevancy. Five stars would mean that five distinct web engines had selected the site within their top ten.

In general, according to some studies (Chignell et al. 1999; Hawking et al. 2001; Bar-Ilan 2005; Mowshowitz and Kawaguchi 2005 and Jacso 2007), "the different search programs or tools use very different ranking algorithms". Hence, the present study, using a confirmative approach and based on a mathematical statistical method, tries to confirm this statement.

[1] Adopted from us.ixquick.com/eng/aboutixquick

RELATED STUDIES

Based on Courtois and Berry (1999), limited studies have been done in the area "ranking algorithm". Singhal and Kaszkiel (2001) compared the performance of a state-of-the-art keyword-based document ranking algorithm with four web SEs (Excite, Google, Lycos and AltaVista) on the ability to recall relevant organizational or individual web pages within the top 10 links. Finally, they reported that web SEs are significantly better than the former.

Furthermore, some studies using ranking algorithm evaluation to examine overlap rate among the results from web search tools can be indicated, for example, Ding and Marchionini (1998), Bharat and Broder (1998), Chignell, Gwizdka and Bodner (1999), Gordon and Pathak (1999), Nicholson (2000), Egghe and Rousseau (2005) and Dogpile.com (2005). Jux2.com (2004), in a report entitled "SEs are more different than people think" offers result of a research as follows:

"The conventional wisdom is that the major SEs serve up similar results. Our research suggests the opposite: the SEs are far more different than most people think. For example, what do you suppose is the overlap between the top 10 results on Google and the top 10 results on Yahoo! for the average search term? Most people we asked thought about 70 percent. So did we, until we checked. The actual overlap is roughly half of that. In tests we conducted using the 500 most popular search terms, on average, Google and Yahoo! shared only 3.8 of their top 10 results. Even more striking is the distribution of results: fully 30% of the search terms had 2 or fewer overlapping terms, and only 17% had 6 or more overlapping results among the top 10".

From such studies, one can conclude that they have demonstrated the real differences among web search tools in terms of indexing, ranking algorithms and search techniques. In addition, it can be said that these works have reported differences in web SEs in the light of websites indexed and algorithms utilized to searchers' queries.

One of the most notable studies supporting the hypothesis of this research is Bar-Ilan (2005). In her survey, she measured how similar are the rankings of SEs on the overlapping results. To do this, using four SEs – Google, AlltheWeb, AltaVista and HotBot – with 15 queries in the area of information retrieval, rankings of results were compared. In conclusion, the findings indicated that web SEs employ considerably different ranking algorithms. Moreover, according to a research study done by Dogpile.com (2007) in collaboration with researchers from Queensland University of Technology and the Pennsylvania State University, SEs differ from one another in two primary ways – their crawling reach and frequency or relevancy

analysis (ranking algorithm). This study evaluated the top four SEs, Google, Yahoo!, Windows Live™ (formerly MSN search) and Ask™ (formerly Ask Jeeves) and measured 19,332 user-entered search queries. The results from this latest study highlight the fact there are vast differences between the four most popular single SEs. Finally, it was demonstrated that "search result ranking differs across major SEs". That is, the top four SEs are not only different in the total first page search results, they are also different in how to rank the first page search results.

To sum up, building this research on previous works mentioned above, this paper reports a comparative study examining ranking algorithms of web search tools. Apparently, method used has some difference with aforementioned studies; especially that it examines a process by means of both SEs and MSEs. For doing this, three SEs, one directory, Yahoo, (here it is grouped into SEs) and five MSEs have been simultaneously applied. Details of the present research process can be seen in Methodology section.

RESEARCH QUESTIONS

Two main questions of this study are:

(1) Is there a difference among ranking algorithms of MSEs compared with their common underlying SEs?

(2) Is there a difference among ranking algorithms of different search tools?

In fact, these questions revolve around the hypothesis mentioned earlier, viz "the different search tools use very different ranking algorithms". So, this research aims to confirm the idea put forward in some previous studies mentioned in the literature using a mathematical method.

METHODOLOGY

To conduct this study, the following search tools were selected. As mentioned in section "related studies", previous studies including Singhal and Kaszkiel (2001), Bar-Ilan (2005), Dogpile.com (2007), and so forth paid more attention to one group of search tools especially SEs. In a word, they have demonstrated the real differences among SEs in terms of indexing, ranking algorithms and search techniques. Yet, methodology used in the present study takes both SEs and MSEs into consideration.

a) Web search tools

- MSEs: Ez2find[2], WebCrawler, Dogpile, MetaCrawler and Info;

[2] It should be reminded that Ez2find has recently changed, i.e. it is not available anymore; when the research was done it had different interface.

- Common underlying SEs: Google, Msn, Ask and Yahoo!

Afterwards, queries or keywords to be searched were identified.

b) Queries or keywords searched

- Internet History
- Great Pyramid
- Bill Clinton
- Globalization
- Developing Countries + Information Technology

c) Data collection

To meet purpose of this study, which is to compare the ranking algorithms of search tools selected, each keyword was searched in each MSE, directory as well as SE. Then, two lists were prepared: one which was based on the first 40 results recalled by the MSE and the other which was based on the first 10 results retrieved by the SE and directory. Afterwards, these lists were compared with each other.

d) Why 10 and 40?

Like Chu and Rosenthal (1996), Tomaiuolo and Packer (1996) and Vaughan (2004), attention has been paid to top 10 results ranked highly within SEs. In addition, as default, these search tools try to show hits retrieved 10 by 10 per page. In this regard, Spink et al (2006) believe that the first result page represents the top results that an engine found for a given query. But, since MSEs typically show 20 links per page and because some of them are duplicates, 40 top hits namely two first pages of each MSE were considered. Hopefully, such a selection helps to increased robustness of this rigorous quantitative method used in the present research.

e) Data analysis[3]

In order to analyze the data collected, the following two statistical tests were used:

(a) Kruskal-Wallis test: when the data is not normal or when we are not sure if it is, the non-parametric Kruskal-Wallis test can be used to compare more than two populations. Since our data might not necessarily be symmetric in this setting, it is better to use the mean as the measure of center, and so in the Kruskal-Wallis test we are testing to see if our population medians are

[3] To learn more about Concepts and Applications of Inferential Statistics, refer to http://faculty.vassar.edu/lowry/webtext.html (accessed 1 Sep. 2008). See also: Kruskal-Wallis one-way analysis of variance, available at: http://en.wikipedia.org/wiki/Kruskal-Wallis_test (accessed 1 Sep. 2008).

equal. That is why we used this to compare ranking algorithms of SEs and MSEs.

(b) Tukey's HSD ("honesty significantly different" test): this post hoc test compares each control group to the other groups. In fact, all pairwise multiple comparisons are made within the Tukey's HSD test at the 0.05 confidence level.

RESULTS AND DISCUSSION

We now address our two research questions: (a) Is there a difference among ranking algorithms of SEs compared with MSEs?; and (b) Is there a difference among ranking algorithms of different search tools?

After replying these questions our hypothesis will be confirmed. As mentioned earlier in data analysis, the first step in the comparison is to compare means of groups of data. Consequently, ranking of 10 first results of common underlying SEs and 40 first ones of their governing MSEs in relation to each query was determined so that calculation of their mean can be facilitated. One case is shown as an example (Table 1).

Table 1: Ranking of Ten First Results of Google in 40 First Results in Ez2find in Association with 5 Queries.

Google (top ten)	Internet History	Great Pyramid	Bill Clinton	Globalization	Developing Countries + Information Technology	Mean
1	2	1	1	4	2	2
2	7	4	6	5	7	5.8
3	8	19	3	22	9	12.2
4	9	7	10	11	0	9.25
5	5	8	11	1	0	2
6	10	2	7	16	0	8.75
7	3	21	21	27	6	15.6
8	4	6	20	9	0	9.75
9	11	17	5	14	0	11.75
10	14	5	22	22	0	13.25

As can be seen in Table 1, in relation to the query "Internet History" for example, the first document ranked in the Google is ranked as the second hit shown in the Ez2find. In order to determine mean of ranking of each query in hits retrieved by target search tools of this case study (SEs, MSEs and web directory), we did plus rankings observed relating to each one of five keywords searched and divided them

by their number namely 5. For instance, as shown in the second row, adding rankings 7, 4, 6, 5 and 7 equals 29; when 29 is divided by 5, the result is equal to 5.8. Accordingly, based on all estimated means Table 2 shows the result of Kruskal-Wallis test. It should be added that here only one table is given. Yet, altogether, the average of the final column in Table 1 and other 19 tables not included in the paper was analyzed by means of the Kruskal-Wallis test which, as mentioned earlier, deals with the mean as the measure of center.

Table 2: Results of Kruskal-Wallis Test

	GOOGLE	YAHOO	ASK	MSN
Chi-Square	19.037	25.490	14.924	13.024
df	5	5	5	5
p-value	.002	.000	.011	.023

Since p-value in Table 2 is less than 0.05, so at the 0.05 confidence level, we can claim that there is a significant difference among means of recalls of SEs and MSEs. In other words, our questions are answered: Not only there is a difference between ranking algorithms of SEs compared with MSEs but there is also a difference between ranking algorithms of different SEs. This result confirms our hypothesis as well as supports Jacso's (2007) view: "the different search programs use very different ranking programs".

However, this analysis only tells us that there is a difference among the groups; it does not specify which groups. Hence, we ran a Tukey's HSD so that rate of difference among the groups can be statistically shown. Admittedly, this test supports result of Kruskal-Wallis test that SEs and MSEs employ different ranking algorithms. As indicated earlier, Tukey's HSD post hoc test compares each control group to the other groups. The asterisks in the mean difference column in Table 3 identify the paired groups that show statistical difference at the 0.05 confidence level or lower. Having a look at Table 3, it can be demonstrated that Google, for instance, is different compared with all other engines but significantly different than Info and MetaCrawler. Additional tables are presented in Appendix A.

Table 3: Dependent variable - Google

Tukey HSD

(I) VAR00006	(J) VAR00006	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Ez2find	Info	-9.5750	3.57934	.099	-20.1808	1.0308
	MetaCrawler	-8.5233	3.57934	.183	-19.1291	2.0825
	WebCrawler	-4.3967	3.57934	.821	-15.0025	6.2091
	Dogpile	-2.2706	4.13306	.994	-14.5171	9.9760
	Google	3.5350	3.57934	.920	-7.0708	14.1408
Info	Ez2find	9.5750	3.57934	.099	-1.0308	20.1808
	MetaCrawler	1.0517	3.57934	1.000	-9.5541	11.6575
	WebCrawler	5.1783	3.57934	.699	-5.4275	15.7841
	Dogpile	7.3045	4.13306	.496	-4.9421	19.5510
	Google	13.1100(*)	3.57934	.008	2.5042	23.7158
MetaCrawler	Ez2find	8.5233	3.57934	.183	-2.0825	19.1291
	Info	-1.0517	3.57934	1.000	-11.6575	9.5541
	WebCrawler	4.1267	3.57934	.857	-6.4791	14.7324
	Dogpile	6.2528	4.13306	.658	-5.9937	18.4993
	Google	12.0583(*)	3.57934	.017	1.4525	22.6641
WebCrawler	Ez2find	4.3967	3.57934	.821	-6.2091	15.0025
	Info	-5.1783	3.57934	.699	-15.7841	5.4275
	MetaCrawler	-4.1267	3.57934	.857	-14.7324	6.4791
	Dogpile	2.1261	4.13306	.995	-10.1204	14.3726
	Google	7.9317	3.57934	.249	-2.6741	18.5375
Dogpile	Ez2find	2.2706	4.13306	.994	-9.9760	14.5171
	Info	-7.3045	4.13306	.496	-19.5510	4.9421
	MetaCrawler	-6.2528	4.13306	.658	-18.4993	5.9937
	WebCrawler	-2.1261	4.13306	.995	-14.3726	10.1204
	Google	5.8056	4.13306	.724	-6.4410	18.0521
Google	Ez2find	-3.5350	3.57934	.920	-14.1408	7.0708
	Info	-13.1100(*)	3.57934	.008	-23.7158	-2.5042
	MetaCrawler	-12.0583(*)	3.57934	.017	-22.6641	-1.4525
	WebCrawler	-7.9317	3.57934	.249	-18.5375	2.6741
	Dogpile	-5.8056	4.13306	.724	-18.0521	6.4410

*The mean difference is significant at the .05 level.

CONCLUSIONS AND FUTURE RESEARCH

Apparently, the research findings confirm that different search tools such as SEs, directories and MSEs make use of different ranking algorithms. In fact, through findings of this study the idea that search tools whether SEs or MSEs employ individual unique ranking algorithms is supported. Consequently, users are advised that to access more relevant resources, it is better to refer to more than one search tool. Again, web users should be aware that limiting searches to single SEs results in

missing substantial pieces of information ranked highly by other SEs and directories (Isfandyari-Moghaddam and Parirokh 2006). By submitting the same query to several search tools, even by looking only at the top 10 or 20 results retrieved by each of the search tools, one can increase the range of the results considerably (Bar-Ilan 2005). This view is significantly reinforced by the present study.

As for the future, it is suggested that larger scale studies are done using further SEs and MSEs not considered in this research including MrSapo and TurboScout as well as Jux2 as the best MSE according to Sullivan (2005; quoted in Isfandyari-Moghaddam 2007). In addition, the number of queries, their variety, and which search strategies are applied to do such web searching studies should be considered. On the other hand, because the web is dynamic and ever-changing and thus web search tools will change, develop, grow, merge and maybe even improve, such research should be performed from time to time. So, it is expected that both the web search tools and their ranking algorithms change constantly which, in turn, need to be evaluated by future studies.

ACKNOWLEDGEMENTS

Special thanks to Professors Rahmatollah Fattahi, Mehri Parirokh, Mohammad Hossein Dayyani, Asadollah Azad and Mohammad Reza Davarpanah for their suggestions and recommendations. Also, we would like to appreciate Ameneh and Fatemeh Beheshti.

REFERENCES

Bar-Ilan, J. 2005. Comparing rankings of search results on the web. *Information Processing and Management*, Vol.41: 1511-1519.

Bar-Ilan, J., Mat-Hassan, M., and Levene, M. 2006. Methods for comparing rankings of search engine results. *Computer Networks*, Vol.50: 1448–1463.

Bharat, K., and Broder, A. 1998. A technique for measuring the relative size and overlap of public Web search engines. *Computer Networks and ISDN Systems*, Vol.30, no.1–7: 379–388.

Brooks, T. A. 2004. The nature of meaning in the Age of Google. *Information Research*, Vol.9, no.3, Available at http://InformationR.net/ir/9-3/paper180.html.

Chignell, M. H., Gwizdka, J., and Bodner, R. C. 1999. Discriminating meta-search: A framework for evaluation. *Information Processing and Management*, Vol.35: 337–362.

Chu, H., and Rosenthal, M. 1996. Search engines for the World Wide Web: A comparative study and evaluation methodology. In *Proceedings of the 59th*

annual meeting of the American Society for Information Science : 127–13. Also available at http://www.asis.org/annual-96/ElectronicProceedings/ chu.html

Courtois, M. P., and Berry, M. W. 1999. Results ranking in Web search engines. *Online*, Vol.23, no.3: 39–46.

Ding, W., and Marchionini, G. 1998. A comparative study of Web search service performance. In *Proceedings of the annual conference of the American Society for Information Science*: 136–142

Dogpile.com. 2005. *Missing pieces: A study of first page web search engine results overlap.* Available at: http://missingpieces.dogpile.com/WhitePaper.pdf

Dogpile.com. 2007. *Different engines, different results web searchers: Not always finding what they're looking for online*. Available at: www.infospaceinc.com/ onlineprod/Overlap-DifferentEnginesDifferentResults.pdf

Egghe, L., and Rousseau, R. 2005. Classical retrieval and overlap measures satisfy the requirements for rankings based on a Lorenz curve. *Information Processing and Management*, Vol.42, no.1: 106–120.

Ellis, D., Ford, N., and Furner, J. 1998. In search of the unknown user: Indexing and hypertext and the World Wide Web. *Journal of Documentation*, Vol.54, no.1: 28–47.

Fattahi, R., Wilson, C. S., and Cole, F. 2008. An alternative approach to natural language query expansion in search engines: Text analysis of general and domain-specific non-topical terms in Web documents. *Information Processing and Management*, Vol.44: 1503–1516.

Gordon, M., and Pathak, P. 1999. Finding information on the world wide web: The retrieval e.ectiveness of search engines. *Information Processing and Management*, Vol.35: 141–180.

Hawking, D., Craswell, N., Bailey, P., and Griths, K. 2001. Measuring search engine quality. *Information Retrieval*, Vol.4: 33–59.

Isfandyari-Moghaddam, A. 2007. Web metasearch engines: A comparative study on search capabilities using an evaluation check-list. *Online Information Review*, Vol.31, no.3: 300-309.

Isfandyari-Moghaddam, A. and Parirokh, M. 2006. A comparative study on overlapping of search results in metasearch engines and their common underlying search engines. *Library Review,* Vol.55, no.5: 301-306.

Jacso, P. 2007. Clustering search results - Part I: Web-wide search engines. *Online Information Review*, Vol.31, No.1: 85-91.

Jansen, B. J., and Molina, P. R. 2006. The effectiveness of Web search engines for retrieving relevant ecommerce links. *Information Processing and Management*, Vol.42: 1075–1098.

Jux2.com. 2004). Search engines are more different than people think. Available at: http://jux2.com/stats.php

Mamma.com. 2007. *About Mamma.com.* Available at: http://www.mamma.com/info/about.html

Margolis, L. 2006. *Searching the Internet*. Available at: http://www.icts.uct.ac.za/WebCourses/Internet/index.htm

Mowshowitz, A., and Kawaguchi, A. 2005. Measuring search engine bias. *Information Processing and Management*, Vol.41: 193–1205.

Nicholson, S. 2000. Raising reliability of Web search tool research through replication and chaos theory. *Journal of the American Society for Information Science*, Vol.51, no.8: 724–729.

Singhal, A., and Kaszkiel, M. 2001. A case study in Web search using TREC algorithms. In *Proceedings of the 10th international World Wide Web conference*, Hong Kong, 1–5 May: 708–716

Spink, A., Greisdorf, H., and Bateman, J. 1998. From highly relevant to not relevant: Examining different regions of relevance. *Information Processing and Management*, Vol.34, no.2/3: 257–274

Spink, A., Jansen, B. J., Blakely, C., and Koshman, S. 2006. A study of results overlap and uniqueness among major web search engines. *Information Processing and Management*, Vol.42: 1379-1391.

Sullivan, D. 2005. *5th annual search engine watch awards.* Available at: http://searchenginewatch.com/showPage.html?page=3494141

Tomaiuolo, N., and Packer, J. 1996. An analysis of Internet search engines: Assessment of over 200 search queries. *Computers in Libraries*, Vol.16, no.6: 58–62.

Vaughan, L. 2004. New measurements for search engine evaluation proposed and tested. *Information Processing and Management*, Vol.40, no.4: 677–691.

Appendix A: Further tables including Tukey HSD

Multiple Comparisons

Dependent Variable: YAHOO

Tukey HSD

(I) VAR00006	(J) VAR00006	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Ez2find	Info	-17.1667(*)	3.91683	.001	-28.7550	-5.5783
	MetaCrawler	-8.3000	3.91683	.294	-19.8883	3.2883
	WebCrawler	-5.9333	3.91683	.656	-17.5217	5.6550
	Dogpile	-8.7167	4.15442	.304	-21.0079	3.5746
	Google	5.5333	3.91683	.719	-6.0550	17.1217
Info	Ez2find	17.1667(*)	3.91683	.001	5.5783	28.7550
	MetaCrawler	8.8667	3.91683	.228	-2.7216	20.4550
	WebCrawler	11.2333	3.91683	.062	-.3550	22.8217
	Dogpile	8.4500	4.15442	.338	-3.8413	20.7413
	Google	22.7000(*)	3.91683	.000	11.1117	34.2883
MetaCrawler	Ez2find	8.3000	3.91683	.294	-3.2883	19.8883
	Info	-8.8667	3.91683	.228	-20.4550	2.7216
	WebCrawler	2.3666	3.91683	.990	-9.2217	13.9550
	Dogpile	-.4167	4.15442	1.000	-12.7080	11.8746
	Google	13.8333(*)	3.91683	.011	2.2450	25.4216
WebCrawler	Ez2find	5.9333	3.91683	.656	-5.6550	17.5217
	Info	-11.2333	3.91683	.062	-22.8217	.3550
	MetaCrawler	-2.3666	3.91683	.990	-13.9550	9.2217
	Dogpile	-2.7833	4.15442	.984	-15.0746	9.5079
	Google	11.4667	3.91683	.054	-.1217	23.0550
Dogpile	Ez2find	8.7167	4.15442	.304	-3.5746	21.0079
	Info	-8.4500	4.15442	.338	-20.7413	3.8413
	MetaCrawler	.4167	4.15442	1.000	-11.8746	12.7080
	WebCrawler	2.7833	4.15442	.984	-9.5079	15.0746
	Google	14.2500(*)	4.15442	.014	1.9587	26.5413
Google	Ez2find	-5.5333	3.91683	.719	-17.1217	6.0550
	Info	-22.7000(*)	3.91683	.000	-34.2883	-11.1117
	MetaCrawler	-13.8333(*)	3.91683	.011	-25.4216	-2.2450
	WebCrawler	-11.4667	3.91683	.054	-23.0550	.1217
	Dogpile	-14.2500(*)	4.15442	.014	-26.5413	-1.9587

*The mean difference is significant at the .05 level.

Multiple Comparisons

Dependent Variable: ASK

Tukey HSD

(I) VAR00006	(J) VAR00006	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Ez2find	Info	-3.9283	3.86851	.910	-15.4409	7.5843
	MetaCrawler	-2.5283	3.15862	.966	-11.9283	6.8717
	WebCrawler	4.7967	3.35022	.708	-5.1735	14.7669
	Dogpile	2.6613	3.35022	.967	-7.3089	12.6314
	Google	8.5050	3.15862	.097	-.8950	17.9050
Info	Ez2find	3.9283	3.86851	.910	-7.5843	15.4409
	MetaCrawler	1.4000	3.86851	.999	-10.1126	12.9126
	WebCrawler	8.7250	4.02647	.273	-3.2577	20.7077
	Dogpile	6.5896	4.02647	.579	-5.3931	18.5723
	Google	12.4333(*)	3.86851	.027	.9207	23.9459
MetaCrawler	Ez2find	2.5283	3.15862	.966	-6.8717	11.9283
	Info	-1.4000	3.86851	.999	-12.9126	10.1126
	WebCrawler	7.3250	3.35022	.264	-2.6452	17.2952
	Dogpile	5.1896	3.35022	.635	-4.7806	15.1598
	Google	11.0333(*)	3.15862	.013	1.6333	20.4333
WebCrawler	Ez2find	-4.7967	3.35022	.708	-14.7669	5.1735
	Info	-8.7250	4.02647	.273	-20.7077	3.2577
	MetaCrawler	-7.3250	3.35022	.264	-17.2952	2.6452
	Dogpile	-2.1354	3.53145	.990	-12.6449	8.3741
	Google	3.7083	3.35022	.876	-6.2619	13.6785
Dogpile	Ez2find	-2.6613	3.35022	.967	-12.6314	7.3089
	Info	-6.5896	4.02647	.579	-18.5723	5.3931
	MetaCrawler	-5.1896	3.35022	.635	-15.1598	4.7806
	WebCrawler	2.1354	3.53145	.990	-8.3741	12.6449
	Google	5.8438	3.35022	.511	-4.1264	15.8139
Google	Ez2find	-8.5050	3.15862	.097	-17.9050	.8950
	Info	-12.4333(*)	3.86851	.027	-23.9459	-.9207
	MetaCrawler	-11.0333(*)	3.15862	.013	-20.4333	-1.6333
	WebCrawler	-3.7083	3.35022	.876	-13.6785	6.2619
	Dogpile	-5.8438	3.35022	.511	-15.8139	4.1264

*The mean difference is significant at the .05 level.

Multiple Comparisons

Dependent Variable: MSN

Tukey HSD

(I) VAR00006	(J) VAR00006	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Ez2find	Info	.3604	3.80839	1.000	-10.9425	11.6633
	MetaCrawler	-1.7125	3.80839	.998	-13.0154	9.5904
	WebCrawler	4.7067	3.59059	.778	-5.9498	15.3632
	Dogpile	.0588	3.80839	1.000	-11.2442	11.3617
	Google	8.8083	3.59059	.159	-1.8481	19.4648
Info	Ez2find	-.3604	3.80839	1.000	-11.6633	10.9425
	MetaCrawler	-2.0729	4.01440	.995	-13.9872	9.8414
	WebCrawler	4.3462	3.80839	.862	-6.9567	15.6491
	Dogpile	-.3017	4.01440	1.000	-12.2160	11.6126
	Google	8.4479	3.80839	.249	-2.8550	19.7508
MetaCrawler	Ez2find	1.7125	3.80839	.998	-9.5904	13.0154
	Info	2.0729	4.01440	.995	-9.8414	13.9872
	WebCrawler	6.4192	3.80839	.548	-4.8837	17.7221
	Dogpile	1.7713	4.01440	.998	-10.1431	13.6856
	Google	10.5208	3.80839	.081	-.7821	21.8237
WebCrawler	Ez2find	-4.7067	3.59059	.778	-15.3632	5.9498
	Info	-4.3462	3.80839	.862	-15.6491	6.9567
	MetaCrawler	-6.4192	3.80839	.548	-17.7221	4.8837
	Dogpile	-4.6479	3.80839	.825	-15.9508	6.6550
	Google	4.1017	3.59059	.861	-6.5548	14.7582
Dogpile	Ez2find	-.0588	3.80839	1.000	-11.3617	11.2442
	Info	.3017	4.01440	1.000	-11.6126	12.2160
	MetaCrawler	-1.7713	4.01440	.998	-13.6856	10.1431
	WebCrawler	4.6479	3.80839	.825	-6.6550	15.9508
	Google	8.7496	3.80839	.215	-2.5533	20.0525
Google	Ez2find	-8.8083	3.59059	.159	-19.4648	1.8481
	Info	-8.4479	3.80839	.249	-19.7508	2.8550
	MetaCrawler	-10.5208	3.80839	.081	-21.8237	.7821
	WebCrawler	-4.1017	3.59059	.861	-14.7582	6.5548
	Dogpile	-8.7496	3.80839	.215	-20.0525	2.5533