Area Estimation for Web Browsing Performance of Users by Applying Numerical Method

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ABSTRACT

Modern web browsers allow web developers to create highly interactive websites which are highly user friendly. Web browser technology has come a long way since its inception although browser compatibility issues remain a concern. This generates problem for the users to choose one among different browsers for accessing information on a required subject. Analysis of browser Share problem was first undertaken by Shukla and Singhai (2011) and they succeed to derive the expression for browser sharing. In fact, this expression has probability based bounded area but definite integral could not solve the problem of estimation of bounded area. In this paper an attempt has been made to estimate total probability area lying under the curve. Mathematical modeling utilized the application of Simpson 3/8 rule in browser sharing phenomena. It is also established by the study that such bounded area possesses linear relationship with the browser failure probability.

Keywords

Browser, Simpson 3/8 rule, Browser failure probability, Area approximation

1. INTRODUCTION

Web browser is an application program that provides a way to look at and interact with all the information on the World Wide Web for fulfillment of many needs. Browser popularity in the market is also an important factor. Naldi(2002) discusses an application of Markov chain on traffic share scenario whereas Shukla and Singhai (2011) utilized this application on browser sharing prospect and some expression of browser share was derived when two browser are installed in a computer system. This expression of browser share gives an area. This bounded area of browser share is a variable therefore many result can be derived from it. Now the problem is how to estimate this area. In this paper a procedure has been suggested for estimating such an appropriate area by using Simpson 3/8 rule which is available in numerical analysis literature.

2. REVIEW OF LITERATURE

Newby and Dagg (2002) proposed inspection and maintenance for stochastically deteriorating systems for average cost criteria with the help of markov chain model. Agarwal and Kaur (2008) discuss a reliability analysis of fault-tolerant multistage interconnection networks and develop a methodology for it. Medhi (1991) has given detail discussion on random movement in every aspect of real time situation through markov chain. Naldi (2002) proposed a new framework on internet traffic share phenomena which is involve between two operator environments. Catledge and Pitkow (1995) suggested some characterizing browsing strategies in the World Wide Web in the field of computer networking. Shukla *et al.*(2007) advocate a model based analysis for space division switching and find some new result for it. Shukla *et al.*(2010) examine crime based user behaviour analysis in the setup of multi operator environment case. Naldi (1999) focused on measurement based modelling of internet dial-up access connections in a new way with the help of markov chain model. Shukla and Thakur (2009) performed state probability analysis of users in internet access traffic sharing in various competitive operator environment cases. Shukla *et al.*(2009) attempt for rest state analysis in internet traffic distribution in multi-operator environment situation. One more similar study is performed due to Shukla and Gadewar (2007) for stochastic model based analysis for cell movement in a knockout switching in the field of networking. Shukla and Singhai (2011) have a useful contribution on user's web browsing behaviour study by using Markov chain model. Shukla *et al.* (2011) conducted a study for elasticity examination of web-browsing behaviour of users with the help of first derivative of browser share expression. Shukla *et al.* (2012a,b,c) develop some new properties of traffic share phenomena in various heterogeneous computer network system through least square based curve fitting technique .Gangele *et al*.(2014a,b) have given a mathematical approach for area estimation of internet traffic share problem in two operators environment situation and develop new aspect for it. Gangele and dongre (2014c, d) have described index based analysis in two call based setup for the judgement of users behaviour in various network situations. Gangele (2014) analysed a new approach for area computation of traffic sharing through Simpson 1/3 rule used in numerical analysis. Shukla *et al.* (2015) advocate probability based approximation of the traffic sharing phenomena by using numerical analysis techniques between two operators in a computer network environment. Shuka and Singhai (2011) derived the following expression of browser sharing

$$\overline{B}_1 = (1-b_1)(1-P_C)\left\{\frac{P+(1-P)(1-P_q)b_2}{1-b_1b_2(1-P_q)^2}\right\}$$

The graph of above expression is based on browser failure probability (b_1 or b_2) and browse sharing ($\overline{B}_1$) of browser B_1. It provides a bounded area A within curve. Basically this bounded area is a variable therefore many result can be drawn, if we estimate such a bounded area .Now the problem is how to estimate this area .In this paper we develop a method for estimating such a bounded area by applying Simpson's 3/8 method which is available in numerical analysis literature.

3. SIMPSON'S 3/8 RULE

Now let y= f(x) be a function to be integrated in the range a to b (a < b). Using functional relationship, we can write n different discrete values of x in range a - b, and can write different y using y=f (x) as below:

x: $x_0, x_1 \ldots x_n$

y: $y_0, y_1 \ldots y_n$, ; (i=1,2,3,4,…n) ;

Where a = x_0, $x_1 < x_2 < x_3 \ldots < x_n$ = b and differencing h= (x_{i+1} - x_i) is like equal interval.

$$I = \int_b^a f(x)dx = \int_b^a y\,dx$$

$$= \frac{3h}{8}\left[\begin{array}{l}(y_0+y_n)+ \\ 3\left(\begin{array}{l} y_1+y_2+y_4+y_5+y_7+ \\ y_8+\ldots+y_{n-2}+y_{n-1}\end{array}\right)+ \\ 2(y_3+y_6+y_9+\ldots+y_{n-3})\end{array}\right]$$

Which is known as Simpson's three eight rule of integration used in numerical analysis.

4. APPLICATION OF SIMPSON'S 3/8 METHOD

We take the followings and consider B_1 = f (b_1) as a function and assume X = Browser failure probability (b_1), Y = Browser sharing is equal to $\overline{B}_1$ and want to evaluate the following integral (as discussed by Shuka and Singhai (2011)) in the limit 0 to 1 are constraints:

$$I = \int_0^1 f(b_1)db_1 =$$

$$\int_0^1 (1-b_1)(1-P_C)\left\{\frac{P+(1-P)(1-P_q)b_2}{1-b_1b_2(1-P_q)^2}\right\}db_1$$

TABLE 1-[For Figure (a) Where (P =0.35, P_q= 0.20, p_c = 0.15, h=0.05)]

b_2	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
b_1	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$
0	0.3417	0.3859	0.4301	0.4743	0.5185	0.5627	0.6069	0.6511	0.6953
0.05	0.3257	0.369	0.4126	0.4564	0.5006	0.545	0.5898	0.6348	0.6801
0.1	0.3095	0.3518	0.3947	0.4381	0.4821	0.5267	0.5718	0.6176	0.664
0.15	0.2933	0.3344	0.3764	0.4193	0.4629	0.5075	0.553	0.5995	0.6469
0.2	0.2769	0.3168	0.3578	0.3999	0.4432	0.4876	0.5333	0.5803	0.6287
0.25	0.2604	0.299	0.3388	0.3800	0.4227	0.4668	0.5126	0.5600	0.6092
0.3	0.2439	0.2809	0.3195	0.3596	0.4015	0.4452	0.4908	0.5385	0.5884
0.35	0.2272	0.2626	0.2997	0.3386	0.3795	0.4225	0.4678	0.5156	0.5661

0.4	0.2104	0.244	0.2795	0.3170	0.3568	0.3989	0.4436	0.4913	0.5421
0.45	0.1935	0.2252	0.2589	0.2948	0.3331	0.3741	0.4181	0.4653	0.5162
0.5	0.1765	0.2061	0.2379	0.272	0.3086	0.3482	0.391	0.4376	0.4883
0.55	0.1594	0.1868	0.2164	0.2484	0.2832	0.321	0.3624	0.4078	0.458
0.6	0.1421	0.1672	0.1944	0.2241	0.2567	0.2925	0.332	0.3759	0.425
0.65	0.1248	0.1473	0.172	0.1991	0.2291	0.2625	0.2997	0.3416	0.389
0.7	0.1073	0.1272	0.1491	0.1734	0.2005	0.2309	0.2653	0.3044	0.3495
0.75	0.0897	0.1067	0.1256	0.1468	0.1706	0.1976	0.2285	0.2642	0.306
0.8	0.072	0.086	0.1016	0.1193	0.1394	0.1624	0.1892	0.2206	0.2579
0.85	0.0542	0.065	0.0771	0.0909	0.1068	0.1253	0.147	0.1729	0.2043
0.9	0.0363	0.0436	0.052	0.0616	0.0728	0.086	0.1017	0.1208	0.1444
0.95	0.0182	0.022	0.0263	0.0313	0.0372	0.0443	0.0528	0.0634	0.0768
AREA(A)=	**0.1738**	**0.2008**	**0.2292**	**0.2591**	**0.29078**	**0.3245**	**0.3605**	**0.3993**	**0.4413**

Looking over table 1 area depends on browser failure probability b_2. For higher value of b_2 area is high where as for lower value it low. The growth rate is from 17 % to 44 % at maximum increment of browser failure probability b_2 and for some constant parameter P = 35 %, P_q= 20 % and p_c = 15 %.

TABLE 2-[For Figure (b) Where (b_2 =0.45, P_q= 0.25, p_c = 0.3, h=0.05)]									
P	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
b_1	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$
0	0.2826	0.329	0.3754	0.4218	0.4681	0.5145	0.5609	0.6073	0.6536
0.05	0.2719	0.3166	0.3612	0.4058	0.4504	0.495	0.5397	0.5843	0.6289
0.1	0.261	0.3038	0.3466	0.3894	0.4323	0.4751	0.5179	0.5607	0.6035
0.15	0.2497	0.2907	0.3317	0.3726	0.4136	0.4546	0.4956	0.5365	0.5775
0.2	0.2382	0.2772	0.3163	0.3554	0.3945	0.4335	0.4726	0.5117	0.5508
0.25	0.2263	0.2634	0.3006	0.3377	0.3748	0.4119	0.4491	0.4862	0.5233
0.3	0.2141	0.2492	0.2844	0.3195	0.3546	0.3897	0.4249	0.4600	0.4951
0.35	0.2016	0.2346	0.2677	0.3008	0.3339	0.3669	0.4000	0.4331	0.4662
0.4	0.1887	0.2196	0.2506	0.2816	0.3125	0.3435	0.3744	0.4054	0.4364
0.45	0.1754	0.2042	0.2330	0.2618	0.2906	0.3194	0.3481	0.3769	0.4057
0.5	0.1618	0.1883	0.2149	0.2414	0.268	0.2945	0.3211	0.3476	0.3742
0.55	0.1478	0.172	0.1962	0.2205	0.2447	0.2690	0.2932	0.3175	0.3417
0.6	0.1333	0.1552	0.177	0.1989	0.2208	0.2427	0.2645	0.2864	0.3083
0.65	0.1184	0.1378	0.1573	0.1767	0.1961	0.2155	0.2350	0.2544	0.2738
0.7	0.103	0.12	0.1369	0.1538	0.1707	0.1876	0.2045	0.2214	0.2383
0.75	0.0872	0.1015	0.1158	0.1301	0.1445	0.1588	0.1731	0.1874	0.2017
0.8	0.0709	0.0825	0.0941	0.1058	0.1174	0.129	0.1407	0.1523	0.1639
0.85	0.054	0.0629	0.0717	0.0806	0.0895	0.0983	0.1072	0.1161	0.1249
0.9	0.0366	0.0426	0.0486	0.0546	0.0606	0.0666	0.0726	0.0786	0.0846
0.95	0.0186	0.0217	0.0247	0.0278	0.0308	0.0339	0.0369	0.0400	0.043
AREA(A)=	**0.1542**	**0.1795**	**0.2048**	**0.2301**	**0.2554**	**0.2807**	**0.306**	**0.3313**	**0.3566**

The table 2 shows the fact that for variation of P bounded area increases when browser failure probability b_2 is 45 %, P_q is 25 % and quitting probability p_c is 30 % with some little increment of browser failure b_1 by 5 %.

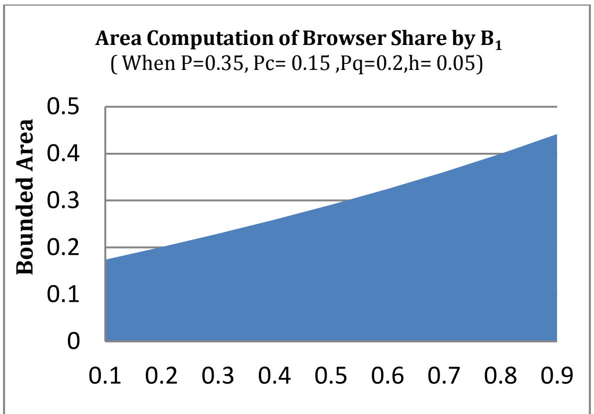


Figure (a)Variation Over b2

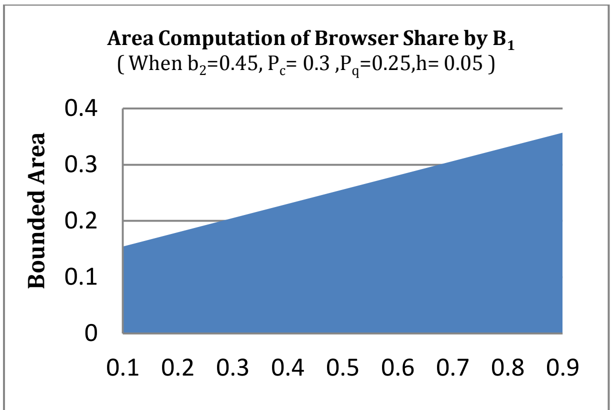


Figure (b) Variation Over P

Figure(a) support the fact of table 1 for increasing pattern over browser failure probability b_2 maximum bounded area is nearly 45 % with some constant parameter where as figure (b) justify the fact related to table 2 that maximum limit of area is 35 % with increase pattern for variation over p.

TABLE 3-[For Figure (c) Where (b_2 =0.05, P= 0.25, p_q = 0.45, h=0.05)]

Pc	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
b_1	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$
0	0.2436	0.2165	0.1894	0.1624	0.1353	0.1083	0.0812	0.0541	0.0271
0.05	0.2316	0.2058	0.1801	0.1544	0.1286	0.1029	0.0772	0.0515	0.0257
0.1	0.2195	0.1951	0.1708	0.1464	0.122	0.0976	0.0732	0.0488	0.0244
0.15	0.2075	0.1844	0.1614	0.1383	0.1153	0.0922	0.0692	0.0461	0.0231
0.2	0.1954	0.1737	0.152	0.1303	0.1086	0.0869	0.0651	0.0434	0.0217
0.25	0.1834	0.163	0.1426	0.1222	0.1019	0.0815	0.0611	0.0407	0.0204
0.3	0.1713	0.1522	0.1332	0.1142	0.0952	0.0761	0.0571	0.0381	0.019
0.35	0.1592	0.1415	0.1238	0.1061	0.0884	0.0707	0.0531	0.0354	0.0177
0.4	0.147	0.1307	0.1144	0.098	0.0817	0.0653	0.049	0.0327	0.0163
0.45	0.1349	0.1199	0.1049	0.0899	0.0749	0.0599	0.0450	0.0300	0.015
0.5	0.1227	0.1091	0.0954	0.0818	0.0682	0.0545	0.0409	0.0273	0.0136
0.55	0.1105	0.0982	0.086	0.0737	0.0614	0.0491	0.0368	0.0246	0.0123
0.6	0.0983	0.0874	0.0765	0.0655	0.0546	0.0437	0.0328	0.0218	0.0109
0.65	0.0861	0.0765	0.067	0.0574	0.0478	0.0383	0.0287	0.0191	0.0096
0.7	0.0739	0.0656	0.0574	0.0492	0.041	0.0328	0.0246	0.0164	0.0082
0.75	0.0616	0.0547	0.0479	0.0411	0.0342	0.0274	0.0205	0.0137	0.0068
0.8	0.0493	0.0438	0.0384	0.0329	0.0274	0.0219	0.0164	0.011	0.0055
0.85	0.037	0.0329	0.0288	0.0247	0.0206	0.0164	0.0123	0.0082	0.0041
0.9	0.0247	0.0219	0.0192	0.0165	0.0137	0.011	0.0082	0.0055	0.0027
0.95	0.0124	0.011	0.0096	0.0082	0.0069	0.0055	0.0041	0.0027	0.0014
AREA(A)=	**0.1219**	**0.1083**	**0.0948**	**0.0812**	**0.0677**	**0.0542**	**0.0406**	**0.0271**	**0.0135**

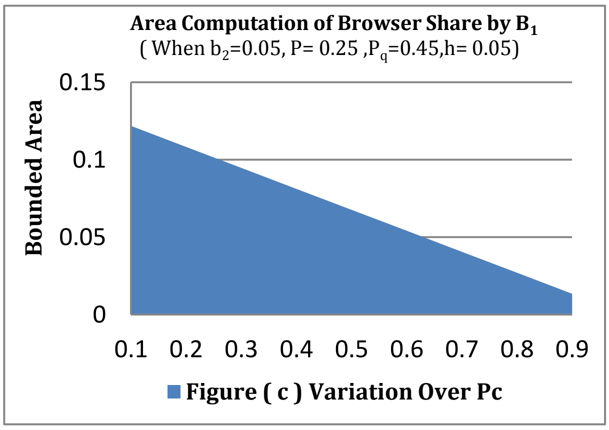
Table 3 indicate the fact that for some constant parameter when browser failure probability b_2 is 5 %, P is 25 % and quitting probability p_q is 45 % area is downward trend for varying parameter P_c by 10 %.

TABLE 4-[For Figure (d) Where (b_2 =0.35, P= 0.45, P_c= 0.15, h=0.05)]

P_q	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
b_1	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$	$\overline{B}_1$
0	0.5298	0.5134	0.497	0.4807	0.4643	0.448	0.4316	0.4152	0.3989
0.05	0.5105	0.4933	0.4763	0.4595	0.443	0.4267	0.4107	0.3947	0.3790
0.1	0.4907	0.4726	0.4551	0.4381	0.4216	0.4054	0.3897	0.3742	0.3591
0.15	0.4703	0.4516	0.4336	0.4164	0.3999	0.384	0.3686	0.3537	0.3392
0.2	0.4493	0.43	0.4118	0.3945	0.3781	0.3624	0.3475	0.3331	0.3193
0.25	0.4276	0.4079	0.3895	0.3722	0.356	0.3407	0.3263	0.3125	0.2994
0.3	0.4053	0.3853	0.3668	0.3497	0.3338	0.3189	0.305	0.2919	0.2795
0.35	0.3823	0.3621	0.3437	0.3269	0.3113	0.297	0.2837	0.2712	0.2596
0.4	0.3585	0.3384	0.3202	0.3037	0.2887	0.2749	0.2623	0.2505	0.2397
0.45	0.334	0.314	0.2962	0.2803	0.2658	0.2527	0.2408	0.2298	0.2197
0.5	0.3086	0.2891	0.2718	0.2565	0.2428	0.2304	0.2192	0.2091	0.1998
0.55	0.2824	0.2635	0.247	0.2324	0.2195	0.208	0.1976	0.1883	0.1798
0.6	0.2553	0.2372	0.2216	0.2080	0.196	0.1854	0.176	0.1675	0.1599
0.65	0.2273	0.2103	0.1958	0.1832	0.1723	0.1627	0.1542	0.1467	0.1399
0.7	0.1983	0.1827	0.1695	0.1582	0.1484	0.1399	0.1324	0.1258	0.1200
0.75	0.1682	0.1543	0.1426	0.1327	0.1242	0.1169	0.1105	0.1049	0.1000
0.8	0.137	0.1251	0.1152	0.1069	0.0999	0.0938	0.0885	0.084	0.0800
0.85	0.1047	0.0951	0.0873	0.0807	0.0752	0.0706	0.0665	0.063	0.0600
0.9	0.0711	0.0643	0.0588	0.0542	0.0504	0.0472	0.0444	0.0421	0.0400
0.95	0.0363	0.0326	0.0297	0.0273	0.0253	0.0237	0.0222	0.021	0.0200
AREA(A)=	**0.2926**	**0.2769**	**0.2628**	**0.2499**	**0.2381**	**0.2272**	**0.2171**	**0.2077**	**0.1988**

Table 4 depicts decrement pattern of bounded area with the variation of web browser parameter b_2 by 35 %, P is 45 % and p_c is 15 % with some little increment of parameter p_q by 10 %.

Figure (c) related to table 3 depicts a downward trend between quitting probability P_c and bounded area (A) for some fixed parameter and nearly 12 % maximum area was seen.



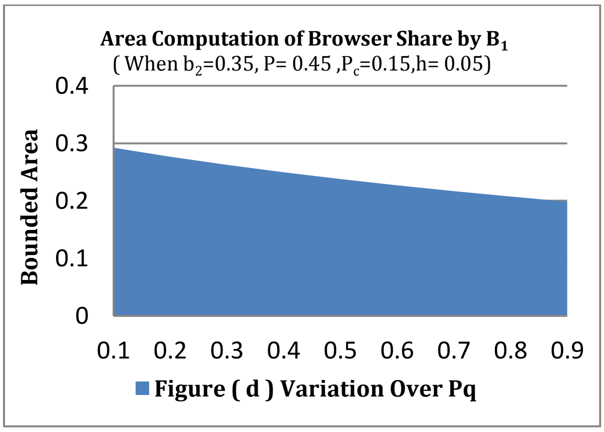


Figure (d) support the fact related to table no. 4 that a linear downward trend was seen at different browser sharing parameter .Nearly 28 % maximum area was found when quitting probability is 15%.

5. CONCLUSION

It is evident from the study that browser share is directly associated with browser failure probability, quitting probability and other parameters. Browser sharing varies from time to time and region to region .Largest achievable area is 45 % when P = 35 %, P_c=15 % and P_q =20 % .Moreover study reveals linear relationship between bounded area and browser failure probability. These parameters affect browser share status at different stages of browser failure. Simpson 3/8 method is quite effective for estimating area of browse share in a setup of two browser environment.

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