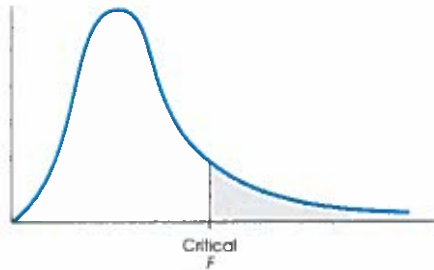


**TABLE B.4 THE F DISTRIBUTION\***

\*Table entries in lightface type are critical values for the .05 level of significance. Boldface type values are for the .01 level of significance.



DEGREES OF FREEDOM: DENOMINATOR	DEGREES OF FREEDOM: NUMERATOR														
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20
1	161 4052	200 4999	216 5403	225 5625	230 5764	234 5859	237 5928	239 5981	241 6022	242 6056	243 6082	244 6106	245 6142	246 6169	248 6208
2	18.51 98.49	19.00 99.00	19.16 99.17	19.25 99.25	19.30 99.30	19.33 99.33	19.36 99.34	19.37 99.36	19.38 99.38	19.39 99.40	19.40 99.41	19.41 99.42	19.42 99.43	19.43 99.44	19.44 99.45
3	10.13 34.12	9.55 30.92	9.28 29.46	9.12 28.71	9.01 28.24	8.94 27.91	8.88 27.67	8.84 27.49	8.81 27.34	8.78 27.23	8.76 27.13	8.74 27.05	8.71 26.92	8.69 26.83	8.66 26.69
4	7.71 21.20	6.94 18.00	6.59 16.69	6.39 15.98	6.26 15.52	6.16 15.21	6.09 14.98	6.04 14.80	6.00 14.66	5.96 14.54	5.93 14.45	5.91 14.37	5.87 14.24	5.84 14.15	5.80 14.02
5	6.61 16.26	5.79 13.27	5.41 12.06	5.19 11.39	5.05 10.97	4.95 10.67	4.88 10.45	4.82 10.27	4.78 10.15	4.74 10.05	4.70 9.96	4.68 9.89	4.64 9.77	4.60 9.68	4.56 9.55
6	5.99 13.74	5.14 10.92	4.76 9.78	4.53 9.15	4.39 8.75	4.28 8.47	4.21 8.26	4.15 8.10	4.10 7.98	4.06 7.87	4.03 7.79	4.00 7.72	3.96 7.60	3.92 7.52	3.87 7.39
7	5.59 12.25	4.74 9.55	4.35 8.45	4.12 7.85	3.97 7.46	3.87 7.19	3.79 7.00	3.73 6.84	3.68 6.71	3.63 6.62	3.60 6.54	3.57 6.47	3.52 6.35	3.49 6.27	3.44 6.15
8	5.32 11.26	4.46 8.65	4.07 7.59	3.84 7.01	3.69 6.63	3.58 6.37	3.50 6.19	3.44 6.03	3.39 5.91	3.34 5.82	3.31 5.74	3.28 5.67	3.23 5.56	3.20 5.48	3.15 5.36
9	5.12 10.56	4.26 8.02	3.86 6.99	3.63 6.42	3.48 6.06	3.37 5.80	3.29 5.62	3.23 5.47	3.18 5.35	3.13 5.26	3.10 5.18	3.07 5.11	3.02 5.00	2.98 4.92	2.93 4.80
10	4.96 10.04	4.10 7.56	3.71 6.55	3.48 5.99	3.33 5.64	3.22 5.39	3.14 5.21	3.07 5.06	3.02 4.95	2.97 4.85	2.94 4.78	2.91 4.71	2.86 4.60	2.82 4.52	2.77 4.41
11	4.84 9.65	3.98 7.20	3.59 6.22	3.36 5.67	3.20 5.32	3.09 5.07	3.01 4.88	2.95 4.74	2.90 4.63	2.86 4.54	2.82 4.46	2.79 4.40	2.74 4.29	2.70 4.21	2.65 4.10
12	4.75 9.33	3.88 6.93	3.49 5.95	3.26 5.41	3.11 5.06	3.00 4.82	2.92 4.65	2.85 4.50	2.80 4.39	2.76 4.30	2.72 4.22	2.69 4.16	2.64 4.05	2.60 3.98	2.54 3.86
13	4.67 9.07	3.80 6.70	3.41 5.74	3.18 5.20	3.02 4.86	2.92 4.62	2.84 4.44	2.77 4.30	2.72 4.19	2.67 4.10	2.63 4.02	2.60 3.96	2.55 3.85	2.51 3.78	2.46 3.67
14	4.60 8.86	3.74 6.51	3.34 5.56	3.11 5.03	2.96 4.69	2.85 4.46	2.77 4.28	2.70 4.14	2.65 4.03	2.60 3.94	2.56 3.86	2.53 3.80	2.48 3.70	2.44 3.62	2.39 3.51
15	4.54 8.68	3.68 6.36	3.29 5.42	3.06 4.89	2.90 4.56	2.79 4.32	2.70 4.14	2.64 4.00	2.59 3.89	2.55 3.80	2.51 3.73	2.48 3.67	2.43 3.56	2.39 3.48	2.33 3.36
16	4.49 8.53	3.63 6.23	3.24 5.29	3.01 4.77	2.85 4.44	2.74 4.20	2.66 4.03	2.59 3.89	2.54 3.78	2.49 3.69	2.45 3.61	2.42 3.55	2.37 3.45	2.33 3.37	2.28 3.25
17	4.45 8.40	3.59 6.11	3.20 5.18	2.96 4.67	2.81 4.34	2.70 4.10	2.62 3.93	2.55 3.79	2.50 3.68	2.45 3.59	2.41 3.52	2.38 3.45	2.33 3.35	2.29 3.27	2.23 3.16
18	4.41 8.28	3.55 6.01	3.16 5.09	2.93 4.58	2.77 4.25	2.66 4.01	2.58 3.85	2.51 3.71	2.46 3.60	2.41 3.51	2.37 3.44	2.34 3.37	2.29 3.27	2.25 3.19	2.19 3.07

TABLE B.4 (continued)

DEGREES OF FREEDOM: DENOMINATOR	DEGREES OF FREEDOM: NUMERATOR														
	1	2	3	4	5	6	7	8	9	10	11	12	14	16	20
19	4.38	3.52	3.13	2.90	2.74	2.63	2.55	2.48	2.43	2.38	2.34	2.31	2.26	2.21	2.15
	8.18	5.93	5.01	4.50	4.17	3.94	3.77	3.63	3.52	3.43	3.36	3.30	3.19	3.12	3.00
20	4.35	3.49	3.10	2.87	2.71	2.60	2.52	2.45	2.40	2.35	2.31	2.28	2.23	2.18	2.12
	8.10	5.85	4.94	4.43	4.10	3.87	3.71	3.56	3.45	3.37	3.30	3.23	3.13	3.05	2.94
21	4.32	3.47	3.07	2.84	2.68	2.57	2.49	2.42	2.37	2.32	2.28	2.25	2.20	2.15	2.09
	8.02	5.78	4.87	4.37	4.04	3.81	3.65	3.51	3.40	3.31	3.24	3.17	3.07	2.99	2.88
22	4.30	3.44	3.05	2.82	2.66	2.55	2.47	2.40	2.35	2.30	2.26	2.23	2.18	2.13	2.07
	7.94	5.72	4.82	4.31	3.99	3.76	3.59	3.45	3.35	3.26	3.18	3.12	3.02	2.94	2.83
23	4.28	3.42	3.03	2.80	2.64	2.53	2.45	2.38	2.32	2.28	2.24	2.20	2.14	2.10	2.04
	7.88	5.66	4.76	4.26	3.94	3.71	3.54	3.41	3.30	3.21	3.14	3.07	2.97	2.89	2.78
24	4.26	3.40	3.01	2.78	2.62	2.51	2.43	2.36	2.30	2.26	2.22	2.18	2.13	2.09	2.02
	7.82	5.61	4.72	4.22	3.90	3.67	3.50	3.36	3.25	3.17	3.09	3.03	2.93	2.85	2.74
25	4.24	3.38	2.99	2.76	2.60	2.49	2.41	2.34	2.28	2.24	2.20	2.16	2.11	2.06	2.00
	7.77	5.57	4.68	4.18	3.86	3.63	3.46	3.32	3.21	3.13	3.05	2.99	2.89	2.81	2.70
26	4.22	3.37	2.98	2.74	2.59	2.47	2.39	2.32	2.27	2.22	2.18	2.15	2.10	2.05	1.99
	7.72	5.53	4.64	4.14	3.82	3.59	3.42	3.29	3.17	3.09	3.02	2.96	2.86	2.77	2.66
27	4.21	3.35	2.96	2.73	2.57	2.46	2.37	2.30	2.25	2.20	2.16	2.13	2.08	2.03	1.97
	7.68	5.49	4.60	4.11	3.79	3.56	3.39	3.26	3.14	3.06	2.98	2.93	2.83	2.74	2.63
28	4.20	3.34	2.95	2.71	2.56	2.44	2.36	2.29	2.24	2.19	2.15	2.12	2.06	2.02	1.96
	7.64	5.45	4.57	4.07	3.76	3.53	3.36	3.23	3.11	3.03	2.95	2.90	2.80	2.71	2.60
29	4.18	3.33	2.93	2.70	2.54	2.43	2.35	2.28	2.22	2.18	2.14	2.10	2.05	2.00	1.94
	7.60	5.42	4.54	4.04	3.73	3.50	3.33	3.20	3.08	3.00	2.92	2.87	2.77	2.68	2.57
30	4.17	3.32	2.92	2.69	2.53	2.42	2.34	2.27	2.21	2.16	2.12	2.09	2.04	1.99	1.93
	7.56	5.39	4.51	4.02	3.70	3.47	3.30	3.17	3.06	2.98	2.90	2.84	2.74	2.66	2.55
32	4.15	3.30	2.90	2.67	2.51	2.40	2.32	2.25	2.19	2.14	2.10	2.07	2.02	1.97	1.91
	7.50	5.34	4.46	3.97	3.66	3.42	3.25	3.12	3.01	2.94	2.86	2.80	2.70	2.62	2.51
34	4.13	3.28	2.88	2.65	2.49	2.38	2.30	2.23	2.17	2.12	2.08	2.05	2.00	1.95	1.89
	7.44	5.29	4.42	3.93	3.61	3.38	3.21	3.08	2.97	2.89	2.82	2.76	2.66	2.58	2.47
36	4.11	3.26	2.86	2.63	2.48	2.36	2.28	2.21	2.15	2.10	2.06	2.03	1.98	1.93	1.87
	7.39	5.25	4.38	3.89	3.58	3.35	3.18	3.04	2.94	2.86	2.78	2.72	2.62	2.54	2.43
38	4.10	3.25	2.85	2.62	2.46	2.35	2.26	2.19	2.14	2.09	2.05	2.02	1.96	1.92	1.85
	7.35	5.21	4.34	3.86	3.54	3.32	3.15	3.02	2.91	2.82	2.75	2.69	2.59	2.51	2.40
40	4.08	3.23	2.84	2.61	2.45	2.34	2.25	2.18	2.12	2.07	2.04	2.00	1.95	1.90	1.84
	7.31	5.18	4.31	3.83	3.51	3.29	3.12	2.99	2.88	2.80	2.73	2.66	2.56	2.49	2.37
42	4.07	3.22	2.83	2.59	2.44	2.32	2.24	2.17	2.11	2.06	2.02	1.99	1.94	1.89	1.82
	7.27	5.15	4.29	3.80	3.49	3.26	3.10	2.96	2.86	2.77	2.70	2.64	2.54	2.46	2.35

TABLE B.5 THE STUDENTIZED RANGE STATISTIC ( $q$ )\*\*The critical values for  $q$  corresponding to  $\alpha = .05$  (lightface type) and  $\alpha = .01$  (boldface type).

df FOR ERROR TERM	$k$ = NUMBER OF TREATMENTS										
	2	3	4	5	6	7	8	9	10	11	12
5	3.64	4.60	5.22	5.67	6.03	6.33	6.58	6.80	6.99	7.17	7.32
	<b>5.70</b>	<b>6.98</b>	<b>7.80</b>	<b>8.42</b>	<b>8.91</b>	<b>9.32</b>	<b>9.67</b>	<b>9.97</b>	<b>10.24</b>	<b>10.48</b>	<b>10.70</b>
6	3.46	4.34	4.90	5.30	5.63	5.90	6.12	6.32	6.49	6.65	6.79
	<b>5.24</b>	<b>6.33</b>	<b>7.03</b>	<b>7.56</b>	<b>7.97</b>	<b>8.32</b>	<b>8.61</b>	<b>8.87</b>	<b>9.10</b>	<b>9.30</b>	<b>9.48</b>
7	3.34	4.16	4.68	5.06	5.36	5.61	5.82	6.00	6.16	6.30	6.43
	<b>4.95</b>	<b>5.92</b>	<b>6.54</b>	<b>7.01</b>	<b>7.37</b>	<b>7.68</b>	<b>7.94</b>	<b>8.17</b>	<b>8.37</b>	<b>8.55</b>	<b>8.71</b>
8	3.26	4.04	4.53	4.89	5.17	5.40	5.60	5.77	5.92	6.05	6.18
	<b>4.75</b>	<b>5.64</b>	<b>6.20</b>	<b>6.62</b>	<b>6.96</b>	<b>7.24</b>	<b>7.47</b>	<b>7.68</b>	<b>7.86</b>	<b>8.03</b>	<b>8.18</b>
9	3.20	3.95	4.41	4.76	5.02	5.24	5.43	5.59	5.74	5.87	5.98
	<b>4.60</b>	<b>5.43</b>	<b>5.96</b>	<b>6.35</b>	<b>6.66</b>	<b>6.91</b>	<b>7.13</b>	<b>7.33</b>	<b>7.49</b>	<b>7.65</b>	<b>7.78</b>
10	3.15	3.88	4.33	4.65	4.91	5.12	5.30	5.46	5.60	5.72	5.83
	<b>4.48</b>	<b>5.27</b>	<b>5.77</b>	<b>6.14</b>	<b>6.43</b>	<b>6.67</b>	<b>6.87</b>	<b>7.05</b>	<b>7.21</b>	<b>7.36</b>	<b>7.49</b>
11	3.11	3.82	4.26	4.57	4.82	5.03	5.20	5.35	5.49	5.61	5.71
	<b>4.39</b>	<b>5.15</b>	<b>5.62</b>	<b>5.97</b>	<b>6.25</b>	<b>6.48</b>	<b>6.67</b>	<b>6.84</b>	<b>6.99</b>	<b>7.13</b>	<b>7.25</b>
12	3.08	3.77	4.20	4.51	4.75	4.95	5.12	5.27	5.39	5.51	5.61
	<b>4.32</b>	<b>5.05</b>	<b>5.50</b>	<b>5.84</b>	<b>6.10</b>	<b>6.32</b>	<b>6.51</b>	<b>6.67</b>	<b>6.81</b>	<b>6.94</b>	<b>7.06</b>
13	3.06	3.73	4.15	4.45	4.69	4.88	5.05	5.19	5.32	5.43	5.53
	<b>4.26</b>	<b>4.96</b>	<b>5.40</b>	<b>5.73</b>	<b>5.98</b>	<b>6.19</b>	<b>6.37</b>	<b>6.53</b>	<b>6.67</b>	<b>6.79</b>	<b>6.90</b>
14	3.03	3.70	4.11	4.41	4.64	4.83	4.99	5.13	5.25	5.36	5.46
	<b>4.21</b>	<b>4.89</b>	<b>5.32</b>	<b>5.63</b>	<b>5.88</b>	<b>6.08</b>	<b>6.26</b>	<b>6.41</b>	<b>6.54</b>	<b>6.66</b>	<b>6.77</b>
15	3.01	3.67	4.08	4.37	4.59	4.78	4.94	5.08	5.20	5.31	5.40
	<b>4.17</b>	<b>4.84</b>	<b>5.25</b>	<b>5.56</b>	<b>5.80</b>	<b>5.99</b>	<b>6.16</b>	<b>6.31</b>	<b>6.44</b>	<b>6.55</b>	<b>6.66</b>
16	3.00	3.65	4.05	4.33	4.56	4.74	4.90	5.03	5.15	5.26	5.35
	<b>4.13</b>	<b>4.79</b>	<b>5.19</b>	<b>5.49</b>	<b>5.72</b>	<b>5.92</b>	<b>6.08</b>	<b>6.22</b>	<b>6.35</b>	<b>6.46</b>	<b>6.56</b>
17	2.98	3.63	4.02	4.30	4.52	4.70	4.86	4.99	5.11	5.21	5.31
	<b>4.10</b>	<b>4.74</b>	<b>5.14</b>	<b>5.43</b>	<b>5.66</b>	<b>5.85</b>	<b>6.01</b>	<b>6.15</b>	<b>6.27</b>	<b>6.38</b>	<b>6.48</b>
18	2.97	3.61	4.00	4.28	4.49	4.67	4.82	4.96	5.07	5.17	5.27
	<b>4.07</b>	<b>4.70</b>	<b>5.09</b>	<b>5.38</b>	<b>5.60</b>	<b>5.79</b>	<b>5.94</b>	<b>6.08</b>	<b>6.20</b>	<b>6.31</b>	<b>6.41</b>
19	2.96	3.59	3.98	4.25	4.47	4.65	4.79	4.92	5.04	5.14	5.23
	<b>4.05</b>	<b>4.67</b>	<b>5.05</b>	<b>5.33</b>	<b>5.55</b>	<b>5.73</b>	<b>5.89</b>	<b>6.02</b>	<b>6.14</b>	<b>6.25</b>	<b>6.34</b>
20	2.95	3.58	3.96	4.23	4.45	4.62	4.77	4.90	5.01	5.11	5.20
	<b>4.02</b>	<b>4.64</b>	<b>5.02</b>	<b>5.29</b>	<b>5.51</b>	<b>5.69</b>	<b>5.84</b>	<b>5.97</b>	<b>6.09</b>	<b>6.19</b>	<b>6.28</b>
24	2.92	3.53	3.90	4.17	4.37	4.54	4.68	4.81	4.92	5.01	5.10
	<b>3.96</b>	<b>4.55</b>	<b>4.91</b>	<b>5.17</b>	<b>5.37</b>	<b>5.54</b>	<b>5.69</b>	<b>5.81</b>	<b>5.92</b>	<b>6.02</b>	<b>6.11</b>
30	2.89	3.49	3.85	4.10	4.30	4.46	4.60	4.72	4.82	4.92	5.00
	<b>3.89</b>	<b>4.45</b>	<b>4.80</b>	<b>5.05</b>	<b>5.24</b>	<b>5.40</b>	<b>5.54</b>	<b>5.65</b>	<b>5.76</b>	<b>5.85</b>	<b>5.93</b>
40	2.86	3.44	3.79	4.04	4.23	4.39	4.52	4.63	4.73	4.82	4.90
	<b>3.82</b>	<b>4.37</b>	<b>4.70</b>	<b>4.93</b>	<b>5.11</b>	<b>5.26</b>	<b>5.39</b>	<b>5.50</b>	<b>5.60</b>	<b>5.69</b>	<b>5.76</b>
60	2.83	3.40	3.74	3.98	4.16	4.31	4.44	4.55	4.65	4.73	4.81
	<b>3.76</b>	<b>4.28</b>	<b>4.59</b>	<b>4.82</b>	<b>4.99</b>	<b>5.13</b>	<b>5.25</b>	<b>5.36</b>	<b>5.45</b>	<b>5.53</b>	<b>5.60</b>
120	2.80	3.36	3.68	3.92	4.10	4.24	4.36	4.47	4.56	4.64	4.71
	<b>3.70</b>	<b>4.20</b>	<b>4.50</b>	<b>4.71</b>	<b>4.87</b>	<b>5.01</b>	<b>5.12</b>	<b>5.21</b>	<b>5.30</b>	<b>5.37</b>	<b>5.44</b>
$\infty$	2.77	3.31	3.63	3.86	4.03	4.17	4.28	4.39	4.47	4.55	4.62
	<b>3.64</b>	<b>4.12</b>	<b>4.40</b>	<b>4.60</b>	<b>4.76</b>	<b>4.88</b>	<b>4.99</b>	<b>5.08</b>	<b>5.16</b>	<b>5.23</b>	<b>5.29</b>

Table 29 of E. Pearson and H. Hartley, *Biometrika Tables for Statisticians*, 3rd ed. New York: Cambridge University Press, 1966. Adapted and reprinted with permission of the Biometrika trustees.