Use the following information to answer the first five exercises. Recently, a nurse in the small town of 'Supafly Rizzle Valley' commented that when a patient calls the medical advice line claiming to have covid-19, the chance that he or she truly has covid-19 (and not just a nasty cold) is only about 20% (see footnote).

Currently, the hospital where the nurse works is getting about 15 of these type of calls per day, and the local hospital has only 200 unoccupied hospital beds. Of the next 15 patients calling in claiming to have covid-19, we are interested in how many actually have covid-19.

footnote — 20% is roughly the Worldometer value from 3/30/20 total people tested: 944,854; total confirmed cases: 161,088

- 1. Define the random variable and list its possible values.
- 2. Find the probability that six of the next 15 calls are from people who actually have covid-19.
- 3. Find the probability that at least four of the 15 calls are from people who actually have covid-19.
- 4. On average, for every 15 people calling in, how many do you expect to actually have covid-19?
- 5. At this rate, in about how many days will the hospital be full?

6. A student takes a ten-question true-false quiz, but did not study and randomly guesses each answer. Find the probability that the student passes the quiz with a grade of at least 70% of the questions correct.

Use the following information to answer the next nine exercises. It has been estimated that only about 30% of California residents have adequate emergency supplies in the event of a catastrophe such as an major earthquake or pandemic.

Suppose you randomly survey 20 California residents. We are interested in the number who have adequate emergency supplies.

- 7. In words, define the random variable X.
- 8. List the values that X may take on.
- 9. What is the probability that more than eleven California residents in the survey of 20 have adequate emergency supplies?
- 10. What is the probability that fewer than three California residents in the survey of 20 have adequate emergency supplies?
- 11. What is the probability that between two and five have adequate emergency supplies?
- 12. Find P(6)
- 13. Find  $P(3 \le x \le 5)$
- 14. Is it more likely that none or that all of the residents surveyed will have adequate emergency supplies? Why?
- 15. How many residents do you expect will have adequate emergency supplies?

**Table 4** Binomial Probability Distribution  $C_{n,r}$   $p^r$   $q^{n-r}$  This table shows the probability of r successes in n independent trials, each with probability of success p.

n	r	.01	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
2	0 1 2	.980 .020 .000	.902 .095 .002	.810 .180 .010	.723 .255 .023	.640 .320 .040	.563 .375 .063	.490 .420 .090	.423 .455 .123	.360 .480 .160	.303 .495 .203	.250 .500 .250	.203 .495 .303	.160 .480 .360	.123 .455 .423	.090 .420 .490	.063 .375 .563	.040 .320 .640	.023 .255 .723	.010 .180 .810	.002 .095 .902
3	0 1 2 3	.970 .029 .000 .000	.857 .135 .007 .000	.729 .243 .027 .001	.614 .325 .057 .003	.512 .384 .096 .008	.422 .422 .141 .016	.343 .441 .189 .027	.275 .444 .239 .043	.216 .432 .288 .064	.166 .408 .334 .091	.125 .375 .375 .125	.091 .334 .408 .166	.064 .288 .432 .216	.043 .239 .444 .275	.027 .189 .441 .343	.016 .141 .422 .422	.008 .096 .384 .512	.003 .057 .325 .614	.001 .027 .243 .729	.000 .007 .135 .857
4	0 1 2 3 4	.961 .039 .001 .000	.815 .171 .014 .000 .000	.656 .292 .049 .004 .000	.522 .368 .098 .011 .001	.410 .410 .154 .026 .002	.316 .422 .211 .047 .004	.240 .412 .265 .076 .008	.179 .384 .311 .112 .015	.130 .346 .346 .154 .026	.092 .300 .368 .200 .041	.062 .250 .375 .250 .062	.041 .200 .368 .300 .092	.026 .154 .346 .346 .130	.015 .112 .311 .384 .179	.008 .076 .265 .412 .240	.004 .047 .211 .422 .316	.002 .026 .154 .410	.001 .011 .098 .368 .522	.000 .004 .049 .292 .656	.000 .000 .014 .171 .815
5	0 1 2 3 4 5	.951 .048 .001 .000 .000	.774 .204 .021 .001 .000	.590 .328 .073 .008 .000	.444 .392 .138 .024 .002	.328 .410 .205 .051 .006	.237 .396 .264 .088 .015	.168 .360 .309 .132 .028	.116 .312 .336 .181 .049	.078 .259 .346 .230 .077 .010	.050 .206 .337 .276 .113 .019	.031 .156 .312 .312 .156	.019 .113 .276 .337 .206 .050	.010 .077 .230 .346 .259	.005 .049 .181 .336 .312 .116	.002 .028 .132 .309 .360 .168	.001 .015 .088 .264 .396 .237	.000 .006 .051 .205 .410	.000 .002 .024 .138 .392 .444	.000 .000 .008 .073 .328	.000 .000 .001 .021 .204
6	0 1 2 3 4 5 6	.941 .057 .001 .000 .000	.735 .232 .031 .002 .000 .000	.531 .354 .098 .015 .001 .000	.377 .399 .176 .042 .006 .000	.262 .393 .246 .082 .015 .002	.178 .356 .297 .132 .033 .004	.118 .303 .324 .185 .060 .010	.075 .244 .328 .236 .095 .020	.047 .187 .311 .276 .138 .037 .004	.028 .136 .278 .303 .186 .061	.016 .094 .234 .312 .234 .094	.008 .061 .186 .303 .278 .136	.004 .037 .138 .276 .311 .187	.002 .020 .095 .236 .328 .244	.001 .010 .060 .185 .324 .303 .118	.000 .004 .033 .132 .297 .356 .178	.000 .002 .015 .082 .246 .393 .262	.000 .000 .006 .042 .176 .399	.000 .000 .001 .015 .098 .354	.000 .000 .000 .002 .031 .232
7	0 1 2 3 4 5 6 7	.932 .066 .002 .000 .000 .000	.698 .257 .041 .004 .000 .000	.478 .372 .124 .023 .003 .000 .000	.321 .396 .210 .062 .011 .001 .000	.210 .367 .275 .115 .029 .004 .000	.133 .311 .311 .173 .058 .012 .001	.082 .247 .318 .227 .097 .025 .004	.049 .185 .299 .268 .144 .047 .008	.028 .131 .261 .290 .194 .077 .017	.015 .087 .214 .292 .239 .117 .032	.008 .055 .164 .273 .273 .164 .055	.004 .032 .117 .239 .292 .214 .087	.002 .017 .077 .194 .290 .261 .131	.001 .008 .047 .144 ;268 .299 .185	.000 .004 .025 .097 .227 .318 .247	.000 .001 .012 .058 .173 .311 .311	.000 .000 .004 .029 .115 .275 .367	.000 .000 .001 .011 .062 .210 .396	.000 .000 .000 .003 .023 .124 .372 .478	.000 .000 .000 .000 .004 .041 .257

Table 4 continued
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n	r	.01	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
8	0	.923	.663	.430	.272	.168	.100	.058	.032	.017	.008	.004	.002	.001	.000	.000	.000	.000	.000	.000	.000
	1	.075	.279	.383	.385	.336	.267	.198	.137	.090	.055	.031	.016	.008	.003	.001	.000	.000	.000	.000	.000
	2	.003	.051	.149	.238	.294	.311	.296	.259	.209	.157	.109	.070	.041	.022	.010	.004	.001	.000	.000	.000
	3 1	.000	.005 .000	.033 .005	.084 :018	.147 .046	.208 .087	.254 .136	.279 .188	.279 .232	.257 .263	.219 .273	.172 .263	.124 .232	.081 .188	.047 .136	.023 .087	.009 .046	.003 .018	.000 .005	.000
	5	.000	.000	.000	.003	.009	.023	.047	.081	.124	.172	.219	.257	.279	.279	.254	.208	.147	.084	.033	.005
	6	.000	.000	.000	.000	.001	.004	.010	.022	.041	.070	.109	.157	.209	.259	.296	.311	.294	.238	.149	.051
	7	.000	.000	.000	.000	.000	.000	.001	.003	.008	.016	.031	.055	.090	.137	.198	.267	.336	.385	.383	.279
	8	.000	.000	.000	.000	.000	000	.000	.000	.001	.002	.004	.008	.017	.032	.058	.100	.168	.272	.430	.663
9	0	.914	.630	.387	.232	.134	.075	.040	.021	.010	.005	.002	.001	.000	.000	.000	.000	.000	.000	.000	.000
	1	.083	.299	.387	.368	.302	.225	.156	.100	.060	.034	.018	.008	.004	.001	.000	.000	.000	.000	.000	.000
	2	.003	.063	.172	.260	.302	.300	.267	.216	.161	.111	.070	.041	.021	.010	.004	.001	.000	.000	.000	.000
	4	.000 .000	.008 .001	.045 .007	.107 .028	.176 .066	.234 .117	.267 .172	.272 .219	.251 .251	.212 .260	.164 .246	.116 .213	.074 .167	.042 .118	.021 .074	.009 .039	.003 .017	.001 .005	.000 .001	.000 .000
	5	.000	.000	.007	.005	.017	.039	.074	.118	.167	.213	.246	.260	.251	.219	.172	.117	.066	.028	.007	.000
	6	.000	.000	.000	.001	.003	.009	.021	.042	.074	.116	.164	.212	.251	.272	.267	.234	.176	.107	.045	.008
	7	.000	.000	.000	.000	.000	.001	.004	.010	.021	.041	.070	.111	.161	.216	.267	.300	.302	.260	.172	.063
	8	.000	.000	.000	.000	.000	.000	.000	.001	.004	.008	.018	.034	.060	.100	.156	.225	.302	.368	.387	.299
	9	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.002	.005	.010	.021	.040	.075	.134	.232	.387	.630
10	0	.904	.599	.349	.197	.107	.056	.028	.014	.006	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.091	.315	.387	.347	.268	.188	.121	.072	.040	.021	.010	.004	.002	.000	.000	.000	.000	.000	.000	.000
	2	.004 .000	.075 .010	.194 .057	.276 .130	.302 .201	.282 .250	.233 .267	.176 .252	.121 .215	.076 .166	.044 .117	.023 .075	.011 .042	.004 .021	.001 .009	.000	.000 .001	.000 .000	.000 .000	.000
	4	.000	.001	.037	.040	.088	.146	.200	.238	.251	.238	.205	.160	.111	.069	.003	.016	.006	.001	.000	.000
	5	.000	.000	.001	.008	.026	.058	.103	.154	.201	.234	.246	.234	.201	.154	.103	.058	.026	.008	.001	.000
	6	.000	.000	.000	.001	.006	.016	.037	.069	.111	.160	.205	.238	.251	.238	.200	.146	.088	.040	.011	.001
	7	.000	.000	.000	.000	.001	.003	.009	.021	.042	.075	.117	.166	.215	.252	.267	.250	.201	.130	.057	.010
	8	.000	.000	.000	.000	.000	.000	.001	.004	.011	.023	.044	.076	.121	.176	.233	.282	.302	.276	.194	.07.
	9	.000	.000	.000	.000	.000	.000	.000	.000	.002	.004	.010	.021	.040	.072	.121	.188	.268	.347	.387	.315
	10	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.006	.014	.028	.056	.107	.197	.349	.599
11	0	.895	.569	.314	.167	.086	.042	.020	.009	.004	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.099	.329	.384	.325	.236	.155	.093	.052	.027	.013	.005	.002	.001	.000	.000	.000	.000	.000	.000	.000
	2	.005 .000	.087 .014	.213 .071	.287 .152	.295 .221	.258 .258	.200 .257	.140 .225	.089 .177	.051 .126	.027 .081	.013 .046	.005 .023	.002 .010	.001 .004	.000 .001	.000 .000	.000 .000	.000 .000	.000 .000
	4	.000	.001	.016	.054	.111	.172	.220	.243	.236	.206	.161	.113	.023	.038	.004	.001	.002	.000	.000	.000
	5	.000	.000	.002	.013	.039	.080	.132	.183	.221	.236	.226	.113	.147	.099	.057	.027	.010	.002	.000	.000
	<b>~</b>	.000	.000	.002	.0.0	.000	.000				00	0			.000		.02.	.0.0	.002	.000	.000

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n	r	.01	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
11	6	.000	.000	.000	.002	.010	.027	.057	.099	.147	.193	.226	.236	.221	.183	.132	.080	.039	.013	.002	.000
	7	.000	.000	.000	.000	.002	.006	.017	.038	.070	.113	.161	.206	.236	.243	.220	.172	.111	.054	.016	.001
	8	.000	.000	.000	.000	.000	.001	.004	.010	.023	.046	.081	.126	.177	.225	.257	.258	.221	.152	.071	.014
	9	.000	.000	.000	.000	.000	.000	.001	.002	.005	.013	.027	.051	.089	.140	.200	.258	.295	.287	.213	.087
	10	.000	.000	.000	.000	.000	.000	.000	.000	.001	.002	.005	.013	.027	.052	.093	.155	.236	.325	.384	.329
	11	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.004	.009	.020	.042	.086	.167	.314	.569
12	0	.886	.540	.282	.142	.069	.032	.014	.006	.002	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.107	.341	.377	.301	.206	.127	.071	.037	.017	.008	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000
	2	.006	.099	.230	.292	.283	.232	.168	.109	.064	.034	.016	.007	.002	.001	.000	.000	.000	.000	.000	.000
	3	.000	.017	.085	.172	.236	.258	.240	.195	.142	.092	.054	.028	.012	.005	.001	.000	.000	.000	.000	.000
	4 5	.000	.002 .000	.021 .004	.068 .019	.133 .053	.194 .103	.231	.237 .204	.213 .227	.170 .223	.121 .193	.076 .149	.042 .101	.020 .059	.008 .029	.002 .011	.001 .003	.000 .001	.000 .000	.000 .000
	6	.000	.000	.004	.004	.033	.103	.158 .079	.204	.22 <i>1</i> .177	.223	.193	.149	.101	.128	.029	.040	.003	.001	.000	.000
	7	.000	.000	.000	.004	.003	.040	.029	.059	.101	.149	.220	.212	.227	.120	.079	.103	.053	.004	.004	.000
	8	.000	.000	.000	.000	.003	.002	.008	.020	.042	.076	.121	.170	.213	.237	.231	.103	.133	.068	.004	.002
	9	.000	.000	.000	.000	.000	.002	.001	.005	.012	.028	.054	.092	.142	.195	.240	.258	.236	.172	.085	.002
	10	.000	.000	.000	.000	.000	.000	.000	.003	.002	.020	.016	.034	.064	.109	.168	.232	.283	.292	.230	.099
	11	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.008	.017	.037	.071	.127	.206	.301	.377	.341
	12	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.002	.006	.014	.032	.069	.142	.282	.540
15	0	.860	.463	.206	.087	.035	.013	.005	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.130	.366	.343	.231	.132	.067	.031	.013	.005	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	2	.009	.135	.267	.286	.231	.156	.092	.048	.022	.009	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000
	3	.000	.031	.129	.218	.250	.225	.170	.111	.063	.032	.014	.005	.002	.000	.000	.000	.000	.000	.000	.000
	4 5	.000	.005	.043	.116	.188	.225	.219	.179	.127 .186	.078	.042	.019	.007 .024	.002	.001	.000	.000 .000	.000	.000 .000	.000
	5 6	.000	.001 .000	.010 .002	.045 .013	.103 .043	.165 .092	.206 .147	.212 .191	.207	.140 .191	.092 .153	.051 .105	.024	.010 .030	.003 .012	.001 .003	.000	.000 .000	.000	.000 .000
	7	.000	.000	.002	.003	.043	.032	.081	.132	.177	.201	.196	.165	.118	.030	.035	.003	.003	.001	.000	.000
	8	.000	.000	.000	.003	.003	.013	.035	.071	.118	.165	.196	.201	.177	.132	.033	.039	.003	.003	.000	.000
	9	.000	.000	.000	.000	.003	.003	.012	.030	.061	.105	.153	.191	.207	.191	.147	.092	.043	.013	.002	.000
	10	.000	.000	.000	.000	.000	.001	.003	.010	.024	.051	.092	.140	.186	.212	.206	.165	.103	.045	.010	.001
	11	.000	.000	.000	.000	.000	.000	.001	.002	.007	.019	.042	.078	.127	.179	.219	.225	.188	.116	.043	.005
	12	.000	.000	.000	.000	.000	.000	.000	.000	.002	.005	.014	.032	.063	.111	.170	.225	.250	.218	.129	.031
	13	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.009	.022	.048	.092	.156	.231	.286	.267	.135
	14	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.002	.005	.013	.031	.067	.132	.231	.343	.366
	15	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.002	.005	.013	.035	.087	.206	.463
16	0	.851	.440	.185	.074	.028	.010	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.138	.371	.329	.210	.113	.053	.023	.009	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

p																					
n	r	.01	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	.55	.60	.65	.70	.75	.80	.85	.90	.95
16	2	.010	.146	.275	.277	.211	.134	.073	.035	.015	.006	.002	.001	.000	.000	.000	.000	.000	.000	.000	.000
	3	.000	.036	.142	.229	.246	.208	.146	.089	.047	.022	.009	.003	.001	.000	.000	.000	.000	.000	.000	.000
	4	.000	.006	.051	.131	.200	.225	.204	.155	.101	.057	.028	.011	.004	.001	.000	.000	.000	.000	.000	.000
	5	.000	.001	.014	.056	.120	.180	.210	.201	.162	.112	.067	.034	.014	.005	.001	.000	.000	.000	.000	.000
	6	.000	.000	.003	.018	.055	.110	.165	.198	.198	.168	.122	.075	.039	.017	.006	.001	.000	.000	.000	.000
	7	.000	.000	.000	.005	.020	.052	.101	.152	.189	.197	.175	.132	.084	.044	.019	.006	.001	.000	.000	.000
	8	.000	.000	.000	.001	.006	.020	.049	.092	.142	.181	.196	.181	.142	.092	.049	.020	.006	.001	.000	.000
	9	.000	.000	.000	.000	.001	.006	.019	.044	.084	.132	.175	.197	.189	.152	.101	.052	.020	.005	.000	.000
	10	.000	.000	.000	.000	.000	.001	.006	.017	.039	.075	.122	.168	.198	.198	.165	.110	.055	.018	.003	.000
	11	.000	.000	.000	.000	.000	.000	.001	.005	.014	.034	.067	.112	.162	.201	.210	.180	.120	.056	.014	.001
	12	.000	.000	.000	.000	.000	.000	.000	.001	.004	.011	.028	.057	.101	.155	.204	.225	.200	.131	.051	.006
	13	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.009	.022	.047	.089	.146	.208	.246	.229	.142	.036
	14	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.002	.006	.015	.035	.073	.134	.211	.277	.275	.146
	15 16	.000	.000	.000	.000	.000 .000	.000 .000	.000 .000	.000	.000 .000	.000 .000	.000 .000	.001 .000	.003	.009 .001	.023 .003	.053 .010	.113 .028	.210 .074	.329 .185	.371 .440
	10	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.010	.020	.074	.100	.440
20	0	.818	.358	.122	.039	.012	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	1	.165	.377	.270	.137	.058	.021	.007	.002	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	2	.016	.189	.285	.229	.137	.067	.028	.010	.003	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000
	3	.001	.060	.190	.243	.205	.134	.072	.032	.012	.004	.001	.000	.000	.000	.000	.000	.000	.000	.000	.000
	4	.000	.013	.090	.182	.218	.190	.130	.074	.035	.014	.005	.001	.000	.000	.000	.000	.000	.000	.000	.000
	5	.000	.002	.032	.103	.175	.202	.179	.127	.075	.036	.015	.005	.001	.000	.000	.000	.000	.000	.000	.000
	6	.000	.000	.009	.045	.109	.169	.192	.171	.124	.075	.037	.015	.005	.001	.000	.000	.000	.000	.000	.000
	7	.000	.000	.002	.016	.055	.112	.164	.184	.166	.122	.074	.037	.015	.005	.001	.000	.000	.000	.000	.000
	8	.000	.000	.000	.005	.022	.061	.114	.161	.180	.162	.120	.073	.035	.014	.004	.001	.000	.000	.000	.000
	9	.000	.000	.000	.001	.007	.027	.065	.116	.160	.177	.160	.119	.071	.034	.012	.003	.000	.000	.000	.000
	10	.000	.000	.000	.000	.002	.010	.031	.069	.117	.159	.176	.159	.117	.069	.031	.010	.002	.000	.000	.000
	11	.000	.000	.000	.000	.000	.003 .001	.012	.034	.071 .035	.119 .073	.160 .120	.177 .162	.160	.116 .161	.065	.027 .061	.007 .022	.001 .005	.000 .000	.000 .000
	12 13	.000	.000 .000	.000	.000	.000 .000	.000	.004 .001	.014 .005	.035	.073	.074	.102	.180 .166	.184	.114 .164	.112	.022	.005	.000	.000
	14	.000	.000	.000	.000	.000	.000	.000	.003	.005	.037	.074	.075	.124	.171	.192	.169	.109	.045	.002	.000
	15	.000	.000	.000	.000	.000	.000	.000	.000	.003	.005	.037	.036	.075	.127	.179	.202	.175	.103	.032	.002
	16	.000	.000	.000	.000	.000	.000	.000	.000	.000	.003	.005	.014	.035	.074	.130	.190	.218	.182	.090	.002
	17	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.003	.004	.012	.032	.072	.134	.205	.243	.190	.060
	18	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.010	.028	.067	.137	.229	.285	.189
	19	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.002	.007	.021	.058	.137	.270	.377
	20	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.001	.003	.012	.039	.122	.358
		.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.00.	.000	.0	.000		.000