

Schriftlich innderung 1

Opf 1)

$3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97, 101, 103, 107, 109, 113, 127, 131, 137, 149, 151, 157, 163, 167, 173, 179, 181, 187, 191, 193, 197, 199, 211, 223, 227, 229, 233, 239, 241, 247, 251, 257, 263, 269, 271, 277, 281, 283, 287, 293, 299, 307, 311, 313, 317, 331, 337, 347, 349, 353, 359, 367, 373, 379, 383, 389, 397, 401, 409, 419, 421, 431, 433, 437, 439, 443, 449, 457, 461, 463, 467, 473, 479, 487, 491, 499, 503, 509, 517, 521, 523, 527, 533, 539, 541, 547, 557, 563, 569, 571, 577, 581, 587, 593, 599, 601, 607, 611, 613, 617, 619, 623, 627, 631, 637, 641, 643, 647, 653, 659, 661, 667, 671, 673, 677, 681, 683, 687, 691, 693, 697, 701, 703, 707, 709, 713, 719, 727, 731, 733, 737, 739, 743, 749, 751, 757, 761, 763, 767, 769, 773, 779, 781, 787, 791, 793, 797, 801, 803, 807, 809, 811, 813, 817, 819, 823, 827, 829, 833, 837, 839, 843, 847, 851, 853, 857, 859, 863, 867, 869, 871, 873, 877, 881, 883, 887, 891, 893, 897, 901, 903, 907, 909, 911, 913, 917, 919, 923, 927, 929, 931, 933, 937, 939, 941, 943, 947, 949, 953, 957, 959, 961, 963, 967, 969, 971, 973, 977, 979, 981, 983, 987, 989, 991, 993, 997, 1001, 1003, 1007, 1009, 1011, 1013, 1017, 1019, 1021, 1023, 1027, 1029, 1031, 1033, 1037, 1039, 1041, 1043, 1047, 1049, 1051, 1053, 1057, 1059, 1061, 1063, 1067, 1069, 1071, 1073, 1077, 1079, 1081, 1083, 1087, 1089, 1091, 1093, 1097, 1099, 1101, 1103, 1107, 1109, 1111, 1113, 1117, 1119, 1121, 1123, 1127, 1129, 1131, 1133, 1137, 1139, 1141, 1143, 1147, 1149, 1151, 1153, 1157, 1159, 1161, 1163, 1167, 1169, 1171, 1173, 1177, 1179, 1181, 1183, 1187, 1189, 1191, 1193, 1197, 1199, 1201, 1203, 1207, 1209, 1211, 1213, 1217, 1219, 1221, 1223, 1227, 1229, 1231, 1233, 1237, 1239, 1241, 1243, 1247, 1249, 1251, 1253, 1257, 1259, 1261, 1263, 1267, 1269, 1271, 1273, 1277, 1279, 1281, 1283, 1287, 1289, 1291, 1293, 1297, 1299, 1301, 1303, 1307, 1309, 1311, 1313, 1317, 1319, 1321, 1323, 1327, 1329, 1331, 1333, 1337, 1339, 1341, 1343, 1347, 1349, 1351, 1353, 1357, 1359, 1361, 1363, 1367, 1369, 1371, 1373, 1377, 1379, 1381, 1383, 1387, 1389, 1391, 1393, 1397, 1399, 1401, 1403, 1407, 1409, 1411, 1413, 1417, 1419, 1421, 1423, 1427, 1429, 1431, 1433, 1437, 1439, 1441, 1443, 1447, 1449, 1451, 1453, 1457, 1459, 1461, 1463, 1467, 1469, 1471, 1473, 1477, 1479, 1481, 1483, 1487, 1489, 1491, 1493, 1497, 1499, 1501, 1503, 1507, 1509, 1511, 1513, 1517, 1519, 1521, 1523, 1527, 1529, 1531, 1533, 1537, 1539, 1541, 1543, 1547, 1549, 1551, 1553, 1557, 1559, 1561, 1563, 1567, 1569, 1571, 1573, 1577, 1579, 1581, 1583, 1587, 1589, 1591, 1593, 1597, 1599, 1601, 1603, 1607, 1609, 1611, 1613, 1617, 1619, 1621, 1623, 1627, 1629, 1631, 1633, 1637, 1639, 1641, 1643, 1647, 1649, 1651, 1653, 1657, 1659, 1661, 1663, 1667, 1669, 1671, 1673, 1677, 1679, 1681, 1683, 1687, 1689, 1691, 1693, 1697, 1699, 1701, 1703, 1707, 1709, 1711, 1713, 1717, 1719, 1721, 1723, 1727, 1729, 1731, 1733, 1737, 1739, 1741, 1743, 1747, 1749, 1751, 1753, 1757, 1759, 1761, 1763, 1767, 1769, 1771, 1773, 1777, 1779, 1781, 1783, 1787, 1789, 1791, 1793, 1797, 1799, 1801, 1803, 1807, 1809, 1811, 1813, 1817, 1819, 1821, 1823, 1827, 1829, 1831, 1833, 1837, 1839, 1841, 1843, 1847, 1849, 1851, 1853, 1857, 1859, 1861, 1863, 1867, 1869, 1871, 1873, 1877, 1879, 1881, 1883, 1887, 1889, 1891, 1893, 1897, 1899, 1901, 1903, 1907, 1909, 1911, 1913, 1917, 1919, 1921, 1923, 1927, 1929, 1931, 1933, 1937, 1939, 1941, 1943, 1947, 1949, 1951, 1953, 1957, 1959, 1961, 1963, 1967, 1969, 1971, 1973, 1977, 1979, 1981, 1983, 1987, 1989, 1991, 1993, 1997, 1999, 2001, 2003, 2007, 2009, 2011, 2013, 2017, 2019, 2021, 2023, 2027, 2029, 2031, 2033, 2037, 2039, 2041, 2043, 2047, 2049, 2051, 2053, 2057, 2059, 2061, 2063, 2067, 2069, 2071, 2073, 2077, 2079, 2081, 2083, 2087, 2089, 2091, 2093, 2097, 2099, 2101, 2103, 2107, 2109, 2111, 2113, 2117, 2119, 2121, 2123, 2127, 2129, 2131, 2133, 2137, 2139, 2141, 2143, 2147, 2149, 2151, 2153, 2157, 2159, 2161, 2163, 2167, 2169, 2171, 2173, 2177, 2179, 2181, 2183, 2187, 2189, 2191, 2193, 2197, 2199, 2201, 2203, 2207, 2209, 2211, 2213, 2217, 2219, 2221, 2223, 2227, 2229, 2231, 2233, 2237, 2239, 2241, 2243, 2247, 2249, 2251, 2253, 2257, 2259, 2261, 2263, 2267, 2269, 2271, 2273, 2277, 2279, 2281, 2283, 2287, 2289, 2291, 2293, 2297, 2299, 2301, 2303, 2307, 2309, 2311, 2313, 2317, 2319, 2321, 2323, 2327, 2329, 2331, 2333, 2337, 2339, 2341, 2343, 2347, 2349, 2351, 2353, 2357, 2359, 2361, 2363, 2367, 2369, 2371, 2373, 2377, 2379, 2381, 2383, 2387, 2389, 2391, 2393, 2397, 2399, 2401, 2403, 2407, 2409, 2411, 2413, 2417, 2419, 2421, 2423, 2427, 2429, 2431, 2433, 2437, 2439, 2441, 2443, 2447, 2449, 2451, 2453, 2457, 2459, 2461, 2463, 2467, 2469, 2471, 2473, 2477, 2479, 2481, 2483, 2487, 2489, 2491, 2493, 2497, 2499, 2501, 2503, 2507, 2509, 2511, 2513, 2517, 2519, 2521, 2523, 2527, 2529, 2531, 2533, 2537, 2539, 2541, 2543, 2547, 2549, 2551, 2553, 2557, 2559, 2561, 2563, 2567, 2569, 2571, 2573, 2577, 2579, 2581, 2583, 2587, 2589, 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3007, 3009, 3011, 3013, 3017, 3019, 3021, 3023, 3027, 3029, 3031, 3033, 3037, 3039, 3041, 3043, 3047, 3049, 3051, 3053, 3057, 3059, 3061, 3063, 3067, 3069, 3071, 3073, 3077, 3079, 3081, 3083, 3087, 3089, 3091, 3093, 3097, 3099, 3101, 3103, 3107, 3109, 3111, 3113, 3117, 3119, 3121, 3123, 3127, 3129, 3131, 3133, 3137, 3139, 3141, 3143, 3147, 3149, 3151, 3153, 3157, 3159, 3161, 3163, 3167, 3169, 3171, 3173, 3177, 3179, 3181, 3183, 3187, 3189, 3191, 3193, 3197, 3199, 3201, 3203, 3207, 3209, 3211, 3213, 3217, 3219, 3221, 3223, 3227, 3229, 3231, 3233, 3237, 3239, 3241, 3243, 3247, 3249, 3251, 3253, 3257, 3259, 3261, 3263, 3267, 3269, 3271, 3273, 3277, 3279, 3281, 3283, 3287, 3289, 3291, 3293, 3297, 3299, 3301, 3303, 3307, 3309, 3311, 3313, 3317, 3319, 3321, 3323, 3327, 3329, 3331, 3333, 3337, 3339, 3341, 3343, 3347, 3349, 3351, 3353, 3357, 3359, 3361, 3363, 3367, 3369, 3371, 3373, 3377, 3379, 3381, 3383, 3387, 3389, 3391, 3393, 3397, 3399, 3401, 3403, 3407, 3409, 3411, 3413, 3417, 3419, 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3837, 3839, 3841, 3843, 3847, 3849, 3851, 3853, 3857, 3859, 3861, 3863, 3867, 3869, 3871, 3873, 3877, 3879, 3881, 3883, 3887, 3889, 3891, 3893, 3897, 3899, 3901, 3903, 3907, 3909, 3911, 3913, 3917, 3919, 3921, 3923, 3927, 3929, 3931, 3933, 3937, 3939, 3941, 3943, 3947, 3949, 3951, 3953, 3957, 3959, 3961, 3963, 3967, 3969, 3971, 3973, 3977, 3979, 3981, 3983, 3987, 3989, 3991, 3993, 3997, 3999, 4001, 4003, 4007, 4009, 4011, 4013, 4017, 4019, 4021, 4023, 4027, 4029, 4031, 4033, 4037, 4039, 4041, 4043, 4047, 4049, 4051, 4053, 4057, 4059, 4061, 4063, 4067, 4069, 4071, 4073, 4077, 4079, 4081, 4083, 4087, 4089, 4091, 4093, 4097, 4099, 4101, 4103, 4107, 4109, 4111, 4113, 4117, 4119, 4121, 4123, 4127, 4129, 4131, 4133, 4137, 4139, 4141, 4143, 4147, 4149, 4151, 4153, 4157, 4159, 4161, 4163, 4167, 4169, 4171, 4173, 4177, 4179, 4181, 4183, 4187, 4189, 4191, 4193, 4197, 4199, 4201, 4203, 4207, 4209, 4211, 4213, 4217, 4219, 4221, 4223, 4227, 4229, 4231, 4233, 4237, 4239, 4241, 4243, 4247, 4249, 4251, 4253, 4257, 4259, 4261, 4263, 4267, 4269, 4271, 4273, 4277, 4279, 4281, 4283, 4287, 4289, 4291, 4293, 4297, 4299, 4301, 4303, 4307, 4309, 4311, 4313, 4317, 4319, 4321, 4323, 4327, 4329, 4331, 4333, 4337, 4339, 4341, 4343, 4347, 4349, 4351, 4353, 4357, 4359, 4361, 4363, 4367, 4369, 4371, 4373, 4377, 4379, 4381, 4383, 4387, 4389, 4391, 4393, 4397, 4399, 4401, 4403, 4407, 4409, 4411, 4413, 4417, 4419, 4421, 4423, 4427, 4429, 4431, 4433, 4437, 4439, 4441, 4443, 4447, 4449, 4451, 4453, 4457, 4459, 4461, 4463, 4467, 4469, 4471, 4473, 4477, 4479, 4481, 4483, 4487, 4489, 4491, 4493, 4497, 4499, 4501, 4503, 4507, 4509, 4511, 4513, 4517, 4519, 4521, 4523, 4527, 4529, 4531, 4533, 4537, 4539, 4541, 4543, 4547, 4549, 4551, 4553, 4557, 4559, 4561, 4563, 4567, 4569, 4571, 4573, 4577, 4579, 4581, 4583, 4587, 4589, 4591, 4593, 4597, 4599, 4601, 4603, 4607, 4609, 4611, 4613, 4617, 4619, 4621, 4623, 4627, 4629, 4631, 4633, 4637, 4639, 4641, 4643, 4647, 4649, 4651, 4653, 4657, 4659, 4661, 4663, 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5081, 5083, 5087, 5089, 5091, 5093, 5097, 5099, 5101, 5103, 5107, 5109, 5111, 5113, 5117, 5119, 5121, 5123, 5127, 5129, 5131, 5133, 5137, 5139, 5141, 5143, 5147, 5149, 5151, 5153, 5157, 5159, 5161, 5163, 5167, 5169, 5171, 5173, 5177, 5179, 5181, 5183, 5187, 5189, 5191, 5193, 5197, 5199, 5201, 5203, 5207, 5209, 5211, 5213, 5217, 5219, 5221, 5223, 5227, 5229, 5231, 5233, 5237, 5239, 5241, 5243, 5247, 5249, 5251, 5253, 5257, 5259, 5261, 5263, 5267, 5269, 5271, 5273, 5277, 5279, 5281, 5283, 5287, 5289, 5291, 5293, 5297, 5299, 5301, 5303, 5307, 5309, 5311, 5313, 5317, 5319, 5321, 5323, 5327, 5329, 5331, 5333, 5337, 5339, 5341, 5343, 5347, 5349, 5351, 5353, 5357, 5359, 5361, 5363, 5367, 5369, 5371, 5373, 5377, 5379, 5381, 5383, 5387, 5389, 5391, 5393, 5397, 5399, 5401, 5403, 5407, 5409, 5411, 5413, 5417, 5419, 5421, 5423, 5427, 5429, 5431, 5433, 5437, 5439, 5441, 5443, 5447, 5449, 5451, 5453, 5457, 5459, 5461, 5463, 5467, 5469, 5471, 5473, 5477, 5479, 5481, 5483, 5487, 5489, 5491, 5493, 5497, 5499, 5501, 5503, 5507, 5509, 5511, 5513, 5517, 5519, 5521, 5523, 5527, 5529, 5531, 5533, 5537, 5539, 5541, 5543, 5547, 5549, 5551, 5553, 5557, 5559, 5561, 5563, 5567, 5569, 5571, 5573, 5577, 5579, 5581, 5583, 5587, 5589, 5591, 5593, 5597, 5599, 5601, 5603, 5607, 5609, 5611, 5613, 5617, 5619, 5621, 5623, 5627, 56$

Oppg 2)

34 kuler, 7 røde, 27 blå, Trekkes en uter i tillegg

A: Alle 7 kuler er røde

B: Nøyaktig 4 kuler er røde

C: Trekkes 7 med nøyaktig 6 røde, så trekkes 1 til hvorav den er rødt

Antas uniform sannsynlighetsmodell $\Rightarrow P = \frac{g}{m}$

$$P(A) = \frac{g}{m}$$

$$m = \binom{34}{7}$$

$$\frac{x}{y} = \frac{x^2}{y} = \frac{x^2}{y^2}$$

$g = 1$ fordi det er bare 1 kombinasjon der alle er røde

$$P(A) = \frac{1}{\binom{34}{7}} = 1,86 \cdot 10^{-7}$$

$$P(B) = \frac{g}{m}$$

$$g = \binom{7}{4} \binom{27}{3} =$$

$$P(B) = \frac{\binom{7}{4} \binom{27}{3}}{\binom{34}{7}} = 0,019$$

$$P(C) = P(6 \text{ røde}) \cdot P(1 \text{ rødt } | 6 \text{ røde})$$

$$P(C) = \frac{\binom{7}{6} \binom{27}{1}}{\binom{34}{7}} \cdot \frac{\binom{1}{1} \binom{26}{0}}{\binom{27}{1}} = \frac{\binom{7}{6} \binom{27}{1}}{\binom{34}{7}} \cdot \frac{1}{27}$$

$$= 1,30 \cdot 10^{-6}$$

Oppgave 3)

300 lodd, 3 er av gevinst A, 3 av B, 294 gir ingen.
Trekket 5 kort

$P(C_1)$ = Vinner nøyaktig 1 lodd av type A = $\frac{3}{n}$

$$n = \binom{300}{5}$$

$$g = \binom{3}{1} \cdot \binom{297}{4}$$

$$P(C_1) = \frac{\binom{3}{1} \binom{297}{4}}{\binom{300}{5}} = \underline{\underline{0,0487}}$$

$P(C_2)$ = minst én av A) = $1 - P(\text{ingen av A})$

$P(\text{ingen av A}) = \frac{g}{n}$

$$n = \binom{300}{5}$$

$$g = \binom{297}{5}$$

$$P(C_2) = 1 - \frac{\binom{297}{5}}{\binom{300}{5}} = \underline{\underline{0,0493}}$$

$P(C_3)$ = Minst én gevinst = $1 - P(\text{ingen gevinst})$

$$= 1 - \frac{\binom{297}{5}}{\binom{300}{5}} = \underline{\underline{0,0967}}$$

Aufgabe 4)

$$A, B, C \in \mathcal{S} \quad P(A) = 0,4 \quad P(B) = 0,3 \quad P(C) = 0,3$$

$$P(A \cup B) = 0,6 \quad P(A \cup C) = 0,5 \quad P(B \cup C) = 0,6$$

$$P(A \cup B \cup C) = 0,7$$

$$P(A \cap B) = P(A) + P(B) - P(A \cup B) = \underline{\underline{0,1}}$$

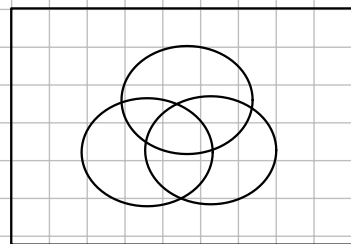
$$P(A \cap B \cap C) = ?$$

$$P(A \cap C) = P(A) + P(C) - P(A \cup C) = 0,2$$

$$P(B \cap C) = P(B) + P(C) - P(B \cup C) = 0$$

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(A \cap C) - P(B \cap C) + P(A \cap B \cap C)$$

$$\begin{aligned} P(A \cap B \cap C) &= P(A \cup B \cup C) + P(A \cap B) + P(A \cap C) + P(B \cap C) - P(A) - P(B) - P(C) \\ &= 0,7 + 0,1 + 0,2 + 0 - 0,4 - 0,3 - 0,3 \\ &= \underline{\underline{0}} \end{aligned}$$



$$P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{0,1}{0,3} = \underline{\underline{\frac{1}{3}}}$$

A & B unabhängig?

$$P(A|B) \stackrel{?}{=} P(A) :$$

$$\frac{1}{3} \neq 0,4 \Rightarrow \underline{\text{Nicht unabhängig}}$$

A & B disjunkt?

$$P(A \cap B) = P(\emptyset) = 0 ?$$

$$P(A \cap B) = 0,1 \Rightarrow \text{Nicht disjunkt}$$

Aufgabe 5)

$$P(F|M) = 0,08 \quad P(F|K) = 0,003$$

$$P(K|F) = ? \quad P(M) = \frac{1}{3} \quad P(K) = \frac{2}{3}$$

$$P(K|F) = \frac{P(F|K) P(K)}{P(F)}$$

$$P(F) = P(F|M) P(M) + P(F|K) P(K)$$

$$P(K|F) = \frac{P(F|K) P(K)}{P(F|M) P(M) + P(F|K) P(K)}$$

$$= \underline{\underline{0,069}}$$

Oppgave 6)

$$P(X \leq 2) = 0,25 + 0,1 + 0,05 = \underline{\underline{0,40}}$$

$$P(X < 2 | X < 4) = \frac{P(X < 2 \cap X < 4)}{P(X < 4)} = \frac{P(X \leq 2)}{P(X < 4)} = \frac{0,40}{0,40 + 0,40} = \underline{\underline{0,5}}$$

$$P(X \leq 2 | X \geq 1) = \frac{P(X \leq 2 \cap X \geq 1)}{P(X \geq 1)} = \frac{P(X = 2 \cup X = 1)}{1 - P(X < 1)} = \frac{0,10 + 0,25}{1 - 0,05}$$

$$= \underline{\underline{0,3684}}$$

Opgave 7)

a)

$$f'(x) = f(x)$$

$$f(x) = \left(1 - e^{-\frac{x^2}{\alpha}}\right)'$$

$$= -\left(-\frac{x^2}{\alpha}\right)' \cdot e^{-\frac{x^2}{\alpha}}$$

$$= \frac{2x}{\alpha} e^{-\frac{x^2}{\alpha}}$$

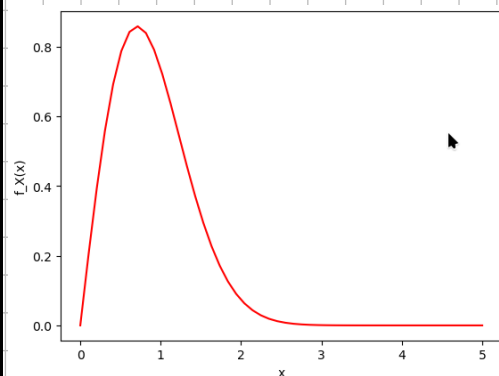
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#Opgave 7a)

def f_X(x, alpha):
    return ((2*x)/alpha) * np.exp((-x**2)/alpha)

x = np.linspace(0, 5)
y = np.zeros(len(x))

for i in range(len(x)):
    y[i] = f_X(x[i], alpha)

plt.plot(x, y, color="red")
plt.xlabel("x")
plt.ylabel("f_X(x)")
plt.show()
```



b)

$$1 - F_Z(z) = P(Z \leq z)$$

$$= P(X \leq z \cap Z \leq z) \text{ uafhængig} \Rightarrow \text{Begge må være sandsynlig}$$

$$= P(X \leq z) P(Z \leq z)$$

$$= \left(1 - e^{-\frac{z^2}{\alpha}}\right) \left(1 - e^{-\frac{z^2}{\alpha}}\right)$$

$$= 1 - 2e^{-\frac{z^2}{\alpha}} + e^{-\frac{2}{\alpha} z^2}$$

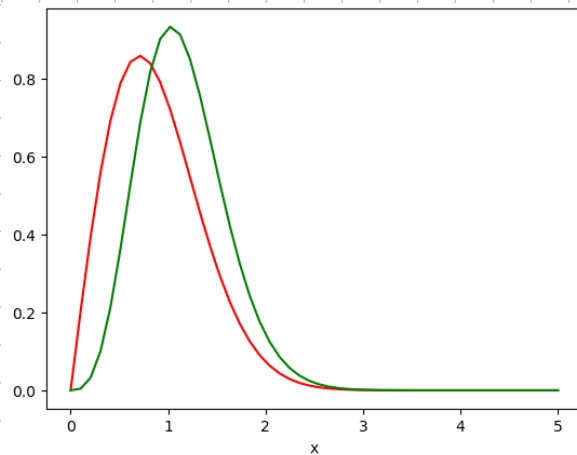
$$f_Z(z) = \frac{2}{\alpha} z e^{-\frac{z^2}{\alpha}} - \frac{4}{\alpha} z e^{-\frac{2}{\alpha} z^2}$$

```
#Oppgave 7b)

def f_Z(z, alpha):
    return (4/alpha)*z*np.exp(-(z**2)/alpha) - (4/alpha)*z*np.exp(-(2*z**2)/alpha)

plt.plot(x, f_X(x, alpha), color="red")
plt.plot(x, f_Z(x, alpha), color="green")
plt.xlabel("x")
plt.ylabel("")
plt.show()

0.0s
```



Kan se att det er en høyere sannsynlighet for instrumentet funker når den består av to komponenter, hvorav bare én trenger å være i stand for att instrumentet skal funke.

Dette ser man fordi den grønne grafen $f_Z(z)$ er forskjøvet mot høyre i forhold til $f_X(x)$.

Oppgave 8)

300 lodd, trekket 5

3 lodd gir gevinst A

3 lodd gir gevinst B

294 gir ingen gevinst

X : Antall gevinster av A

Y : Antall gevinster av B

$$f_X(x) = \frac{1}{5}$$

$$g = \binom{3}{x} \binom{297}{5-x}$$

$$f_X(x) = \frac{\binom{3}{x} \binom{297}{5-x}}{\binom{300}{5}}$$

$$f_{XY}(x, y) = \frac{\binom{3}{x} \binom{3}{y} \binom{294}{5-x-y}}{\binom{300}{5}}$$

$$f_X(x) = \sum_y f_{XY}(x, y) = \sum_y \frac{\binom{3}{x} \binom{3}{y} \binom{294}{5-x-y}}{\binom{300}{5}} = \frac{\binom{3}{x}}{\binom{300}{5}} \sum_y \binom{3}{y} \binom{294}{5-x-y}$$

$$= \frac{\binom{3}{x}}{\binom{300}{5}} \cdot \binom{3+294}{5-x} = \frac{\binom{3}{x} \binom{297}{5-x}}{\binom{300}{5}}$$

