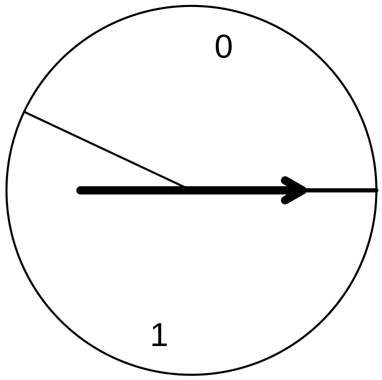
1. **Problem:**
   Determine the probabilities when adding up 3 Bernoulli trials if each trial has chance 0.57. Each trial could be thought of as a spin of the spinner below.

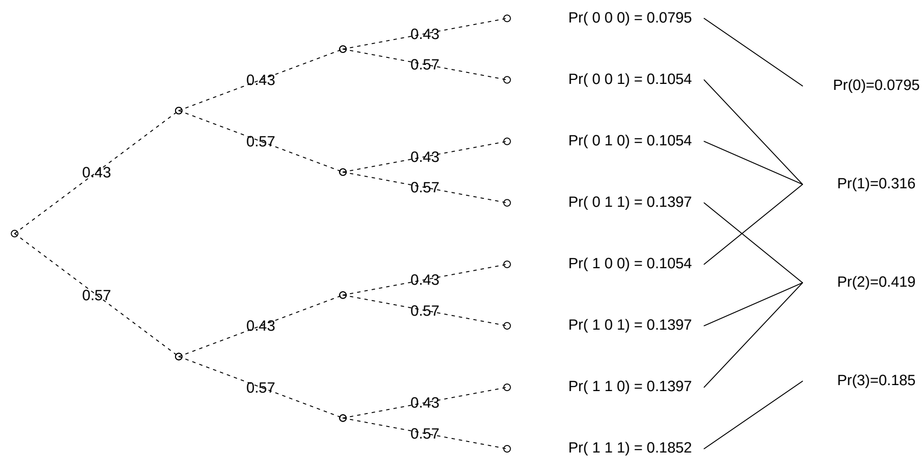
   

   Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

   Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x(p)^x(1-p)^{n-x}$$

We want 4 probabilities, letting x vary from 0 to 3. For each probability, $n = 3$ and $p = 0.57$. A table is useful.

x	${}_nC_x p^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_3C_0)(0.57)^0(1-0.57)^{3-0}$	0.0795
1	$({}_3C_1)(0.57)^1(1-0.57)^{3-1}$	0.316
2	$({}_3C_2)(0.57)^2(1-0.57)^{3-2}$	0.419
3	$({}_3C_3)(0.57)^3(1-0.57)^{3-3}$	0.185

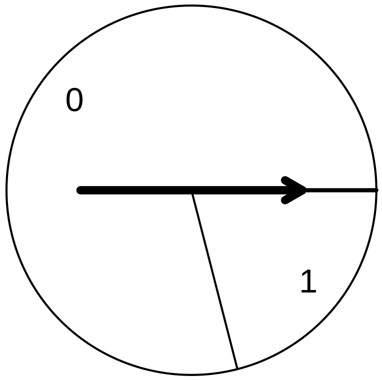
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.0795	0	-1.71	2.92	0.232
1	0.316	0.316	-0.709	0.503	0.159
2	0.419	0.838	0.291	0.0847	0.0355
3	0.185	0.555	1.29	1.67	0.308
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 1.709$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.734$
		$\mu = 1.709$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.86$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (3)(0.57) = 1.71$$

$$\sigma = \sqrt{npq} = \sqrt{(3)(0.57)(0.43)} = \sqrt{0.735} = 0.857$$

2. **Problem:**
   Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.21. Each trial could be thought of as a spin of the spinner below.

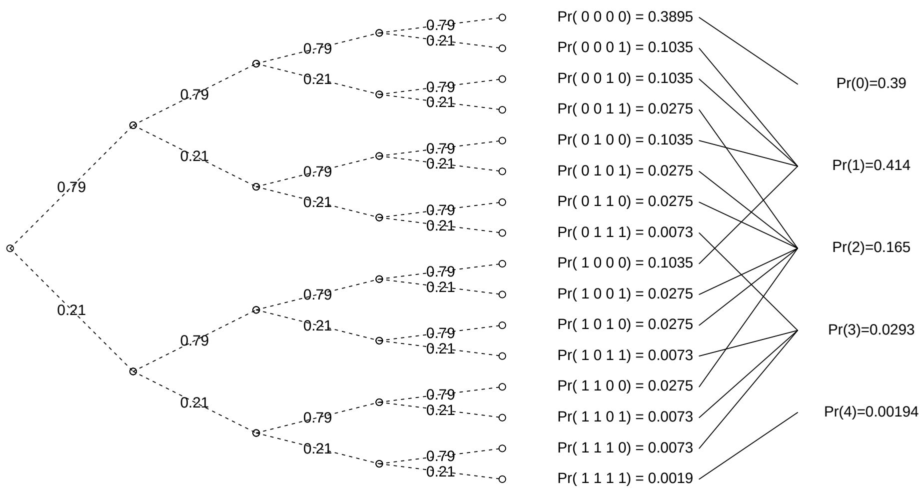
   .image

   Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

   Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x(p)^x(1-p)^{n-x}$$

We want 5 probabilities, letting x vary from 0 to 4. For each probability, $n = 4$ and $p = 0.21$. A table is useful.

x	${}_nC_x p^x (1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.21)^0(1-0.21)^{4-0}$	0.39
1	$({}_4C_1)(0.21)^1(1-0.21)^{4-1}$	0.414
2	$({}_4C_2)(0.21)^2(1-0.21)^{4-2}$	0.165
3	$({}_4C_3)(0.21)^3(1-0.21)^{4-3}$	0.0293
4	$({}_4C_4)(0.21)^4(1-0.21)^{4-4}$	0.00194

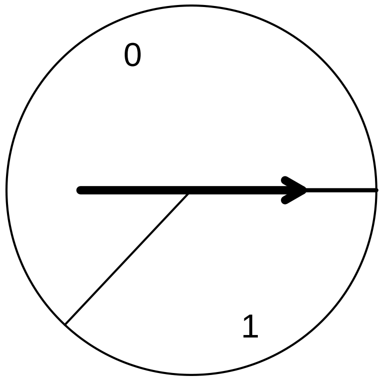
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.39	0	-0.84	0.705	0.275
1	0.414	0.414	0.16	0.0257	0.0106
2	0.165	0.33	1.16	1.35	0.222
3	0.0293	0.0879	2.16	4.67	0.137
4	0.00194	0.00776	3.16	9.99	0.0194
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 0.8397$			$\sum (x_i-\mu)^2 \cdot Pr(x) = 0.664$
		$\mu = 0.8397$			$\sigma = \sqrt{\sum (x_i-\mu)^2 \cdot Pr(x)} = 0.81$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (4)(0.21) = 0.84$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.21)(0.79)} = \sqrt{0.664} = 0.815$$

3. **Problem:**
   Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.37. Each trial could be thought of as a spin of the spinner below.



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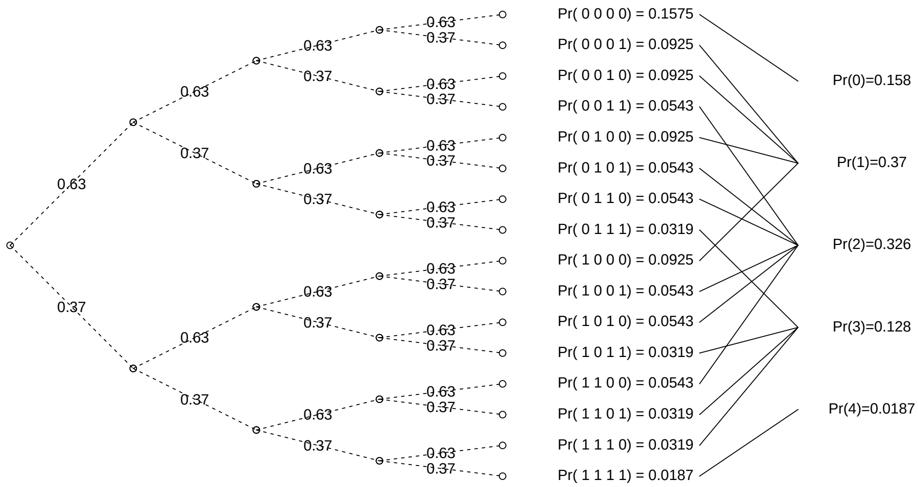
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x(p)^x(1-p)^{n-x}$$

We want 5 probabilities, letting x vary from 0 to 4. For each probability, $n = 4$ and $p = 0.37$. A table is useful.

x	${}_nC_xp^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.37)^0(1-0.37)^{4-0}$	0.158
1	$({}_4C_1)(0.37)^1(1-0.37)^{4-1}$	0.37
2	$({}_4C_2)(0.37)^2(1-0.37)^{4-2}$	0.326
3	$({}_4C_3)(0.37)^3(1-0.37)^{4-3}$	0.128
4	$({}_4C_4)(0.37)^4(1-0.37)^{4-4}$	0.0187

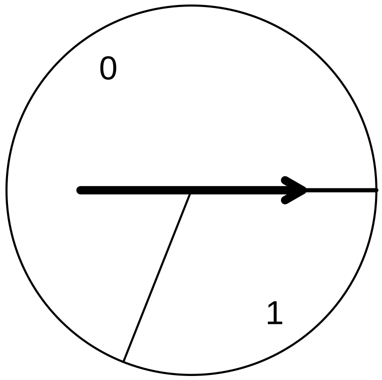
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.158	0	-1.48	2.19	0.347
1	0.37	0.37	-0.481	0.231	0.0856
2	0.326	0.652	0.519	0.269	0.0878
3	0.128	0.384	1.52	2.31	0.295
4	0.0187	0.0748	2.52	6.35	0.119
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 1.481$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.934$
		$\mu = 1.481$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.97$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (4)(0.37) = 1.48$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.37)(0.63)} = \sqrt{0.932} = 0.966$$

4. **Problem:**
Determine the probabilities when adding up 3 Bernoulli trials if each trial has chance 0.31. Each trial could be thought of as a spin of the spinner below.



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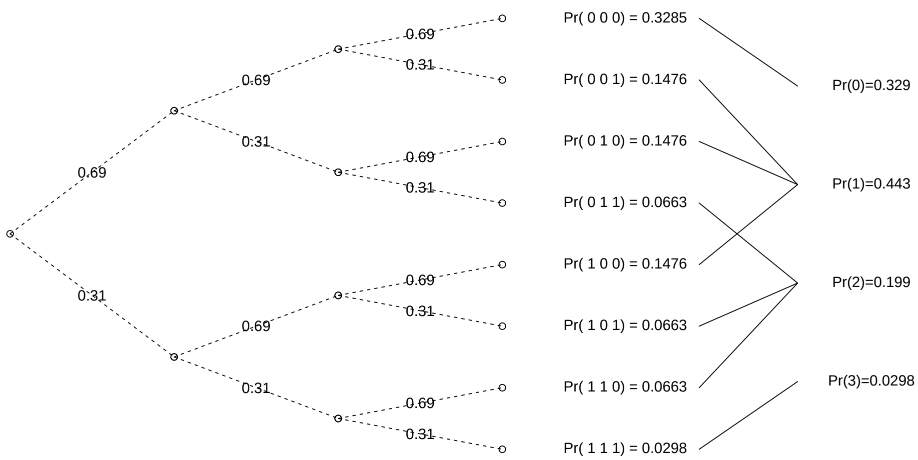
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x (p)^x (1-p)^{n-x}$$

We want 4 probabilities, letting x vary from 0 to 3. For each probability, $n = 3$ and $p = 0.31$. A table is useful.

x	${}_nC_x p^x (1-p)^{n-x}$	$\Pr(x)$
0	$({}_3C_0)(0.31)^0(1-0.31)^{3-0}$	0.329
1	$({}_3C_1)(0.31)^1(1-0.31)^{3-1}$	0.443
2	$({}_3C_2)(0.31)^2(1-0.31)^{3-2}$	0.199
3	$({}_3C_3)(0.31)^3(1-0.31)^{3-3}$	0.0298

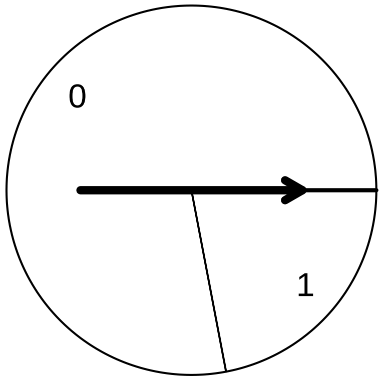
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.329	0	-0.93	0.866	0.285
1	0.443	0.443	0.0696	0.00484	0.00215
2	0.199	0.398	1.07	1.14	0.228
3	0.0298	0.0894	2.07	4.28	0.128
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 0.9304$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.643$
		$\mu = 0.9304$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.8$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (3)(0.31) = 0.93$$

$$\sigma = \sqrt{npq} = \sqrt{(3)(0.31)(0.69)} = \sqrt{0.642} = 0.801$$

5. **Problem:**
Determine the probabilities when adding up 3 Bernoulli trials if each trial has chance 0.22. Each trial could be thought of as a spin of the spinner below.



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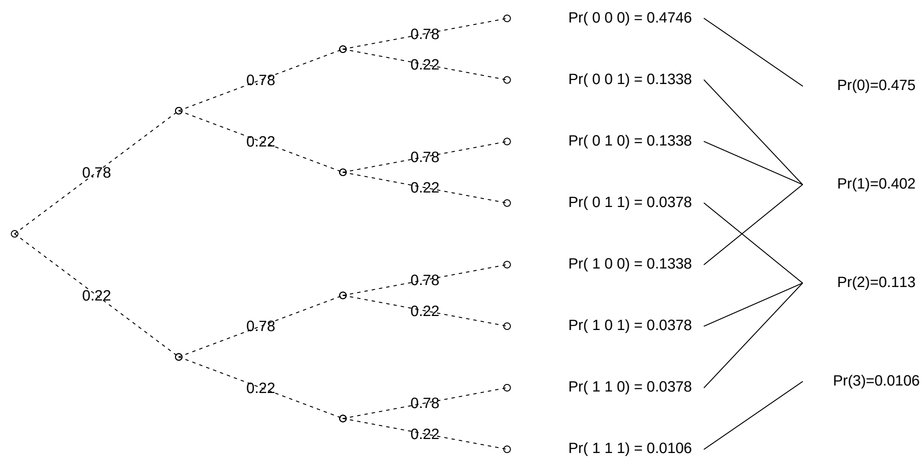
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x(p)^x(1-p)^{n-x}$$

We want 4 probabilities, letting x vary from 0 to 3. For each probability, $n = 3$ and $p = 0.22$. A table is useful.

x	${}_nC_xp^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_3C_0)(0.22)^0(1-0.22)^{3-0}$	0.475
1	$({}_3C_1)(0.22)^1(1-0.22)^{3-1}$	0.402
2	$({}_3C_2)(0.22)^2(1-0.22)^{3-2}$	0.113
3	$({}_3C_3)(0.22)^3(1-0.22)^{3-3}$	0.0106

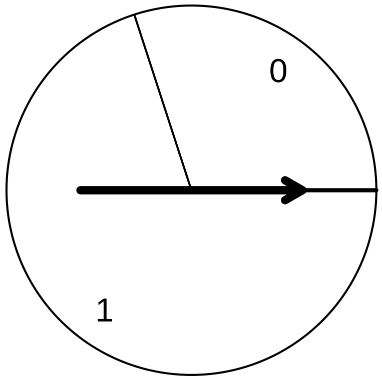
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.475	0	-0.66	0.435	0.207
1	0.402	0.402	0.34	0.116	0.0465
2	0.113	0.226	1.34	1.8	0.203
3	0.0106	0.0318	2.34	5.48	0.0581
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 0.6598$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.515$
		$\mu = 0.6598$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.72$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (3)(0.22) = 0.66$$

$$\sigma = \sqrt{npq} = \sqrt{(3)(0.22)(0.78)} = \sqrt{0.515} = 0.717$$

6. **Problem:**
Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.7. Each trial could be thought of as a spin of the spinner below.



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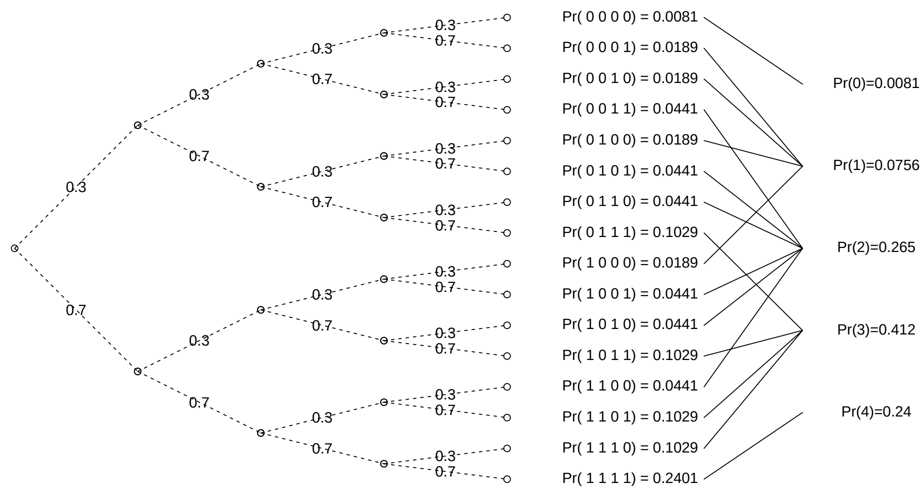
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x(p)^x(1-p)^{n-x}$$

We want 5 probabilities, letting x vary from 0 to 4. For each probability, $n = 4$ and $p = 0.7$. A table is useful.

x	${}_nC_x p^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.7)^0(1-0.7)^{4-0}$	0.0081
1	$({}_4C_1)(0.7)^1(1-0.7)^{4-1}$	0.0756
2	$({}_4C_2)(0.7)^2(1-0.7)^{4-2}$	0.265
3	$({}_4C_3)(0.7)^3(1-0.7)^{4-3}$	0.412
4	$({}_4C_4)(0.7)^4(1-0.7)^{4-4}$	0.24

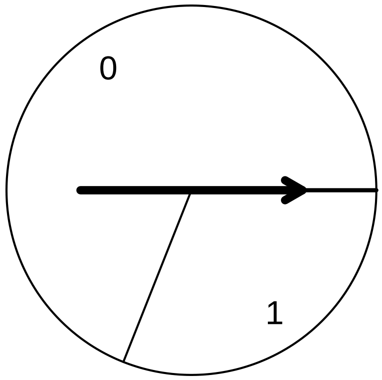
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.0081	0	-2.8	7.85	0.0636
1	0.0756	0.0756	-1.8	3.25	0.245
2	0.265	0.53	-0.802	0.643	0.17
3	0.412	1.24	0.198	0.0392	0.0162
4	0.24	0.96	1.2	1.44	0.344
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 2.802$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.839$
		$\mu = 2.802$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.92$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (4)(0.7) = 2.8$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.7)(0.3)} = \sqrt{0.84} = 0.917$$

7. **Problem:**
Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.31. Each trial could be thought of as a spin of the spinner below.



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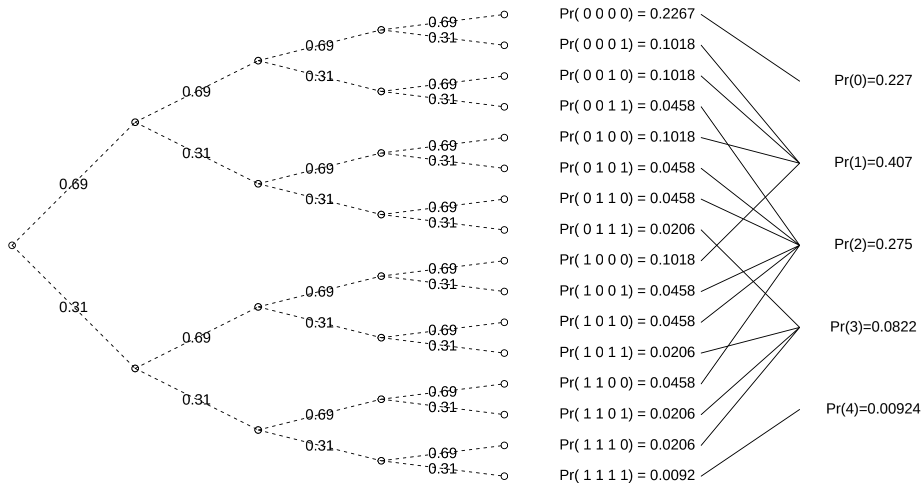
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x (p)^x (1-p)^{n-x}$$

We want 5 probabilities, letting x vary from 0 to 4. For each probability, $n = 4$ and $p = 0.31$. A table is useful.

x	${}_nC_x p^x (1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.31)^0(1-0.31)^{4-0}$	0.227
1	$({}_4C_1)(0.31)^1(1-0.31)^{4-1}$	0.407
2	$({}_4C_2)(0.31)^2(1-0.31)^{4-2}$	0.275
3	$({}_4C_3)(0.31)^3(1-0.31)^{4-3}$	0.0822
4	$({}_4C_4)(0.31)^4(1-0.31)^{4-4}$	0.00924

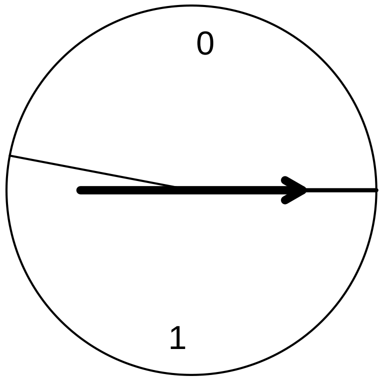
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.227	0	-1.24	1.54	0.35
1	0.407	0.407	-0.241	0.0581	0.0236
2	0.275	0.55	0.759	0.576	0.158
3	0.0822	0.247	1.76	3.09	0.254
4	0.00924	0.037	2.76	7.61	0.0703
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 1.241$			$\sum (x_i-\mu)^2 \cdot Pr(x) = 0.856$
		$\mu = 1.241$			$\sigma = \sqrt{\sum (x_i-\mu)^2 \cdot Pr(x)} = 0.93$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (4)(0.31) = 1.24$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.31)(0.69)} = \sqrt{0.856} = 0.925$$

8. **Problem:**
   Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.53. Each trial could be thought of as a spin of the spinner below.

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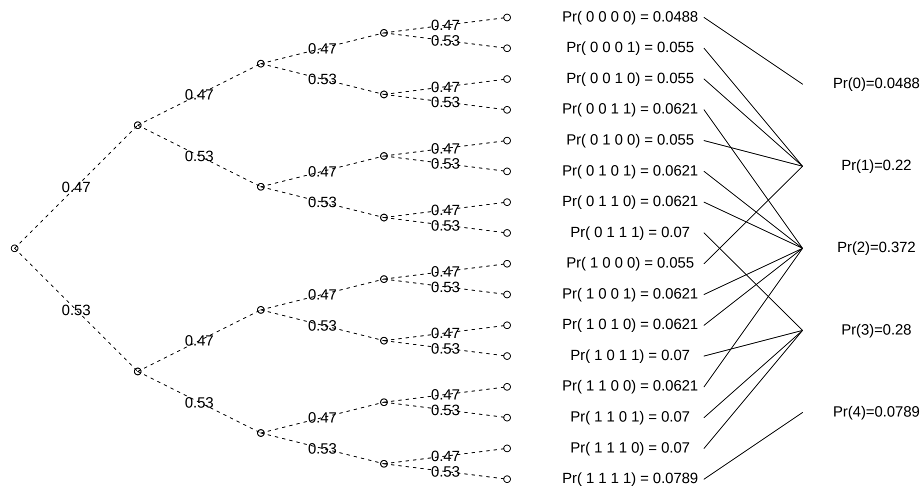
   Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

   Then, show $\mu = np$ and $\sigma = \sqrt{npq}$. (Remember these formulas only work for binomial distributions.)

Solution:

You could make a tree.



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You could also just use the binomial formula.

$$\Pr(x) = {}_nC_x(p)^x(1-p)^{n-x}$$

We want 5 probabilities, letting x vary from 0 to 4. For each probability, $n = 4$ and $p = 0.53$. A table is useful.

x	${}_nC_x p^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.53)^0(1-0.53)^{4-0}$	0.0488
1	$({}_4C_1)(0.53)^1(1-0.53)^{4-1}$	0.22
2	$({}_4C_2)(0.53)^2(1-0.53)^{4-2}$	0.372
3	$({}_4C_3)(0.53)^3(1-0.53)^{4-3}$	0.28
4	$({}_4C_4)(0.53)^4(1-0.53)^{4-4}$	0.0789

x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.0488	0	-2.12	4.49	0.219
1	0.22	0.22	-1.12	1.25	0.276
2	0.372	0.744	-0.12	0.0144	0.00536
3	0.28	0.84	0.88	0.774	0.217
4	0.0789	0.316	1.88	3.53	0.279
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 2.12$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.996$
		$\mu = 2.12$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 1$

Then we confirm the binomial mean and binomial SD formulas work.

$$\mu = np = (4)(0.53) = 2.12$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.53)(0.47)} = \sqrt{0.996} = 0.998$$