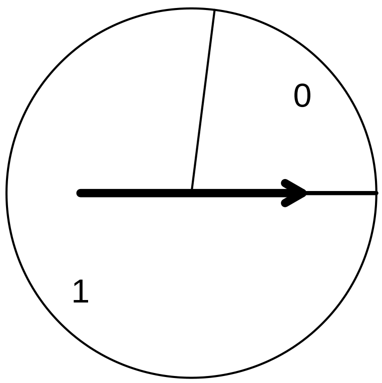
1. **Problem:**
   Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.77. Each trial could be thought of as a spin of the spinner below.

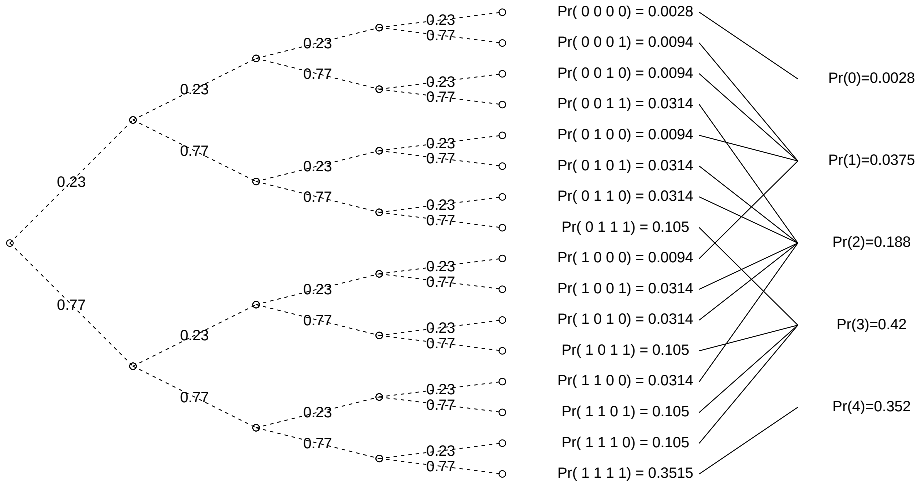
   

   Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

   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 5 probabilities, letting x vary from 0 to 4. For each probability, $n = 4$ and $p = 0.77$. A table is useful.

x	${}_nC_x p^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.77)^0(1-0.77)^{4-0}$	0.0028
1	$({}_4C_1)(0.77)^1(1-0.77)^{4-1}$	0.0375
2	$({}_4C_2)(0.77)^2(1-0.77)^{4-2}$	0.188
3	$({}_4C_3)(0.77)^3(1-0.77)^{4-3}$	0.42
4	$({}_4C_4)(0.77)^4(1-0.77)^{4-4}$	0.352

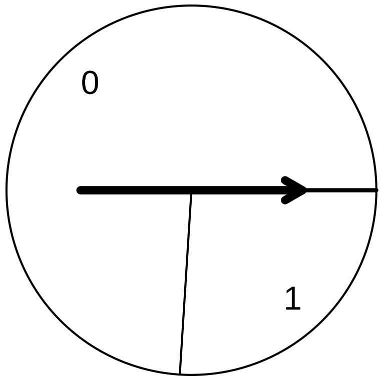
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.0028	0	-3.08	9.5	0.0266
1	0.0375	0.0375	-2.08	4.33	0.163
2	0.188	0.376	-1.08	1.17	0.22
3	0.42	1.26	-0.082	0.00672	0.00282
4	0.352	1.41	0.918	0.843	0.297
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 3.082$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.709$
		$\mu = 3.082$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.84$

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

$$\mu = np = (4)(0.77) = 3.08$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.77)(0.23)} = \sqrt{0.708} = 0.842$$

2. **Problem:**
Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.26. Each trial could be thought of as a spin of the spinner below.



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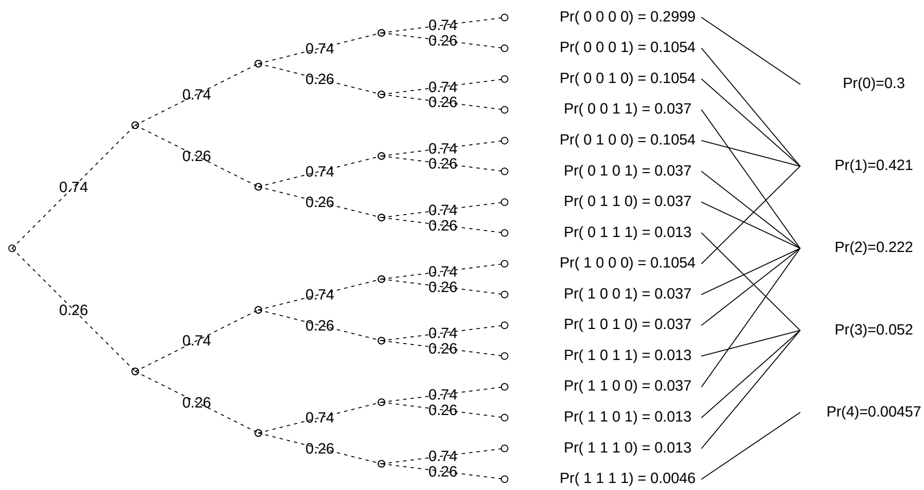
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

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 $p = 0.26$. A table is useful.

x	${}_nC_x p^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.26)^0(1-0.26)^{4-0}$	0.3
1	$({}_4C_1)(0.26)^1(1-0.26)^{4-1}$	0.421
2	$({}_4C_2)(0.26)^2(1-0.26)^{4-2}$	0.222
3	$({}_4C_3)(0.26)^3(1-0.26)^{4-3}$	0.052
4	$({}_4C_4)(0.26)^4(1-0.26)^{4-4}$	0.00457

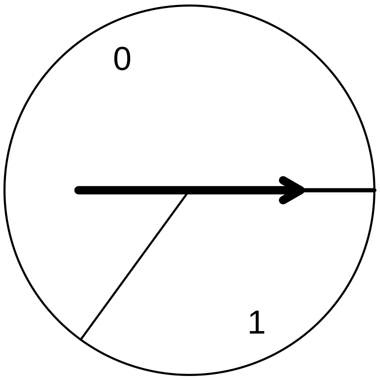
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.3	0	-1.04	1.08	0.324
1	0.421	0.421	-0.039	0.00152	0.00064
2	0.222	0.444	0.961	0.924	0.205
3	0.052	0.156	1.96	3.85	0.2
4	0.00457	0.0183	2.96	8.77	0.0401
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 1.039$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.77$
		$\mu = 1.039$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.88$

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

$$\mu = np = (4)(0.26) = 1.04$$

$$\sigma = \sqrt{npq} = \sqrt{(4)(0.26)(0.74)} = \sqrt{0.77} = 0.877$$

3. **Problem:**
   Determine the probabilities when adding up 3 Bernoulli trials if each trial has chance 0.35. Each trial could be thought of as a spin of the spinner below.

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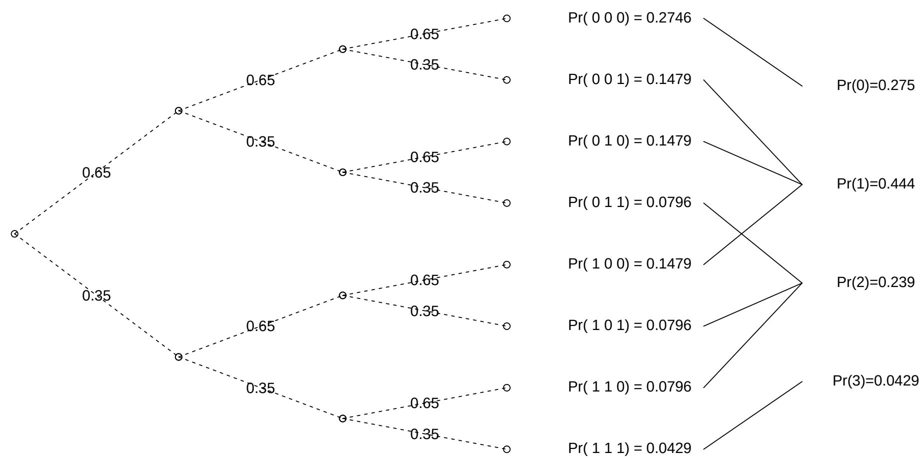
   Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x-\mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

   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 $p = 0.35$. A table is useful.

x	${}_nC_x p^x (1-p)^{n-x}$	$\Pr(x)$
0	$({}_3C_0)(0.35)^0(1-0.35)^{3-0}$	0.275
1	$({}_3C_1)(0.35)^1(1-0.35)^{3-1}$	0.444
2	$({}_3C_2)(0.35)^2(1-0.35)^{3-2}$	0.239
3	$({}_3C_3)(0.35)^3(1-0.35)^{3-3}$	0.0429

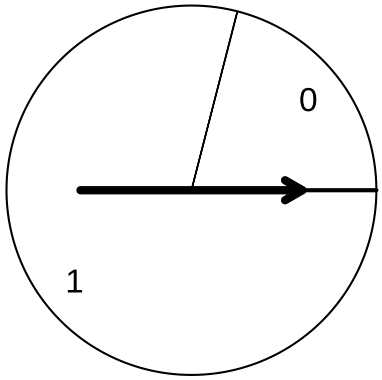
x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.275	0	-1.05	1.1	0.304
1	0.444	0.444	-0.051	0.0026	0.00115
2	0.239	0.478	0.949	0.901	0.215
3	0.0429	0.129	1.95	3.8	0.163
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 1.051$			$\sum (x_i-\mu)^2 \cdot Pr(x) = 0.683$
		$\mu = 1.051$			$\sigma = \sqrt{\sum (x_i-\mu)^2 \cdot Pr(x)} = 0.83$

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

$$\mu = np = (3)(0.35) = 1.05$$

$$\sigma = \sqrt{npq} = \sqrt{(3)(0.35)(0.65)} = \sqrt{0.682} = 0.826$$

4. **Problem:**
   Determine the probabilities when adding up 4 Bernoulli trials if each trial has chance 0.79. Each trial could be thought of as a spin of the spinner below.



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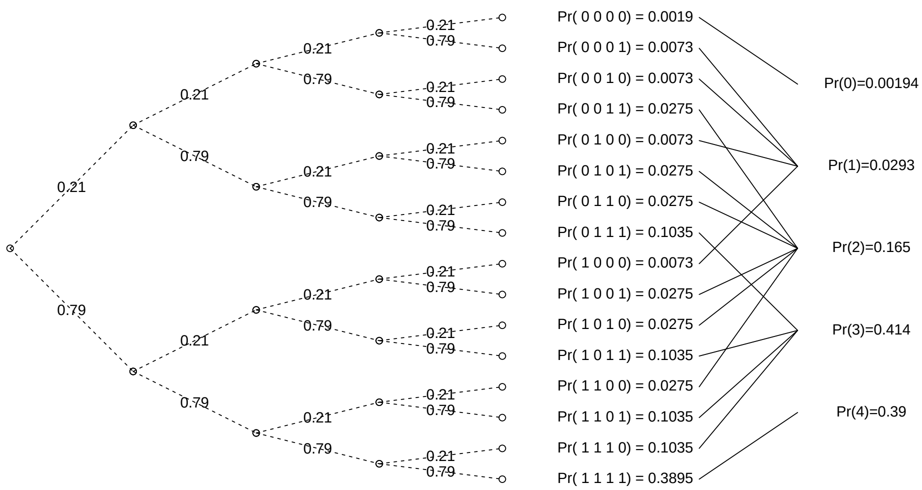
Then, use $\mu = \sum x \cdot \Pr(x)$ to find the mean and $\sigma = \sqrt{\sum (x - \mu)^2 \cdot \Pr(x)}$ to determine the standard deviation.

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 $p = 0.79$. A table is useful.

x	${}_nC_x p^x(1-p)^{n-x}$	$\Pr(x)$
0	$({}_4C_0)(0.79)^0(1-0.79)^{4-0}$	0.00194
1	$({}_4C_1)(0.79)^1(1-0.79)^{4-1}$	0.0293
2	$({}_4C_2)(0.79)^2(1-0.79)^{4-2}$	0.165
3	$({}_4C_3)(0.79)^3(1-0.79)^{4-3}$	0.414
4	$({}_4C_4)(0.79)^4(1-0.79)^{4-4}$	0.39

x	$Pr(x)$	$x \cdot Pr(x)$	$x-\mu$	$(x-\mu)^2$	$(x-\mu)^2 \cdot Pr(x)$
0	0.00194	0	-3.16	9.99	0.0194
1	0.0293	0.0293	-2.16	4.67	0.137
2	0.165	0.33	-1.16	1.35	0.222
3	0.414	1.24	-0.161	0.0259	0.0107
4	0.39	1.56	0.839	0.704	0.275
=========	=========	=========	=========	=========	=========
		$\sum x \cdot Pr(x) = 3.161$			$\sum(x_i-\mu)^2 \cdot Pr(x) = 0.664$
		$\mu = 3.161$			$\sigma = \sqrt{\sum(x_i-\mu)^2 \cdot Pr(x)} = 0.81$

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

$$\mu = np = (4)(0.79) = 3.16$$

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