Halving

```
The original block reward is 50 BTC or 5 billion Satoshi.
```

Halving happens every 4 years, every 210,000 blocks.

So how does the coinbase get to zero if it's cut in half, forever?

Answer: the coinbase is **cut in "half"** by **dropping its last bit**, until there are no more bits (it's zero).

```
In[791]:=
      Grid[
        Prepend[
         Table[
          year = 2008 + (4 * x);
          halving = x + 1;
          sat = BitShiftRight[coinbase, x];
          btc = sat / 100 000 000;
           year,
           halving,
           AccountingForm[btc // N, 8],
           sat,
           BaseForm[sat, 2],
           NumberForm[btc * 210 000, 5] // N
          },
          \{x, 0, 32\}], {
          "Year"
          , "Epoch"
          , Column[{"Block Reward", "(BTC)"}, Alignment → Right]
          , Column[{"Block Reward", "(satoshi)"}, Alignment → Right]
          , "Satoshi (in binary)"
          , Column[{"210k blocks", "total (BTC)"}, Alignment → Right]
         }
        ]
        , Frame → All, Alignment → CenterDot, Background → LightYellow
      ]
```

Out[791]=

2116 28 0.00000037 37 1001012 0.0777 2120 29 0.00000018 18 100102 0.0378 2124 30 0.00000009 9 10012 0.0189 2128 31 0.00000004 4 1002 0.0084 2132 32 0.00000002 2 102 0.0042		ı		T = .		1
Color Colo	Year	Epoch			Satoshi (in binary)	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		•				
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2008	1	50.	5 000 000 000	10010101000000101111100100000	1.05×10^7
2016 3					00002	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2012	2	25.	2 500 000 000	10010101000000101111100100000	$\textbf{5.25} \times \textbf{10}^{6}$
					0002	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2016	3	12.5	1 250 000 000	10010101000000101111100100000	$\textbf{2.625} \times \textbf{10}^{6}$
2024 5					00 ₂	
2028 6 1.5625 15625000 10010101000000101111100100002 328130 2032 7 0.78125 78125000 1001010100000010111110010002 164060 2036 8 0.390625 39062500 100101010000001011111001002 82031 2040 9 0.1953125 19531250 10010101000000101111100102 41016 2044 10 0.09765625 9765625 100101010000001011111001 20508 2048 11 0.04882812 482812 100101010000001011111002 5127 2050 12 0.02441406 2441406 1001010100000010111110 2524 2055 13 0.01220703 1220703 1001010100000010111112 2563.5 2060 14 0.00610351 610351 100101010000001011112 460.87 2064 15 0.00305175 305175 1001010100000010112 640.87 2068 16 0.00152587 152587 100101010000001012 40.053 2072 17 0.00076293 <t< td=""><td>2020</td><td>4</td><td>6.25</td><td>625 000 000</td><td>1001010100000010111110010000002</td><td>1.3125 × 10⁶</td></t<>	2020	4	6.25	625 000 000	1001010100000010111110010000002	1.3125 × 10 ⁶
2032	2024	5	3.125	312 500 000	100101010000001011111001000002	656250.
2036 8	2028	6	1.5625	156 250 000	10010101000000101111100100002	328130.
2040 9 0.1953125 19531250 100101010000001011111100102 41016. 2044 10 0.09765625 9765625 1001010100000010111110012 20508. 2048 11 0.04882812 4882812 100101010000001011111002 10254. 2052 12 0.02441406 2441406 10010101000000101111102 5127. 2056 13 0.01220703 1220703 1001010100000010111112 2563.5 2060 14 0.00610351 610351 100101010000001011112 640.87 2064 15 0.00395175 305175 10010101000000101112 640.87 2068 16 0.00152587 152587 100101010000001012 320.43 2072 17 0.00076293 76293 10010101000000102 80.107 2084 20 0.0009536 38146 1001010100000012 40.053 2084 20 0.00004768 4768 10010101000002 20.026 2084 21 0.0004768 4768 10	2032	7	0.78125	78 125 000	1001010100000010111110010002	164060.
2044 10 0.09765625 9765625 1001010100000010111110012 20508. 2048 11 0.04882812 4882812 100101010000001011111002 10254. 2052 12 0.02441406 2441406 10010101000000101111102 5127. 2056 13 0.01220703 1220703 1001010100000010111112 2563.5 2060 14 0.00610351 610351 100101010000001011112 640.87 2064 15 0.00305175 305175 10010101000000101112 640.87 2068 16 0.00152587 152587 1001010100000010112 320.43 2072 17 0.00076293 76293 100101010000001012 160.22 2076 18 0.00038146 38146 10010101000000102 80.107 2080 19 0.00019973 19 973 1001010100000012 40.053 2084 20 0.00004768 4768 10010101000002 20.026 2088 21 0.0004768 4768 100101010	2036	8	0.390625	39 062 500	100101010000001011111001002	82031.
2048 11 0.04882812 4882812 1001010100000010111111002 10254. 2052 12 0.02441406 2441406 10010101000000101111102 5127. 2056 13 0.01220703 1220703 1001010100000010111112 2563.5 2060 14 0.00610351 610351 100101010000001011112 640.87 2064 15 0.00305175 305175 1001010100000010112 640.87 2068 16 0.00152587 152587 100101010000001012 160.22 2076 18 0.00038146 38146 10010101000000102 80.107 2080 19 0.00019073 19 973 1001010100000012 40.053 2084 20 0.00009536 9536 100101010000002 20.026 2088 21 0.00004768 4768 1001010100002 5.0064 2096 23 0.0000298 2384 100101010002 2.5032 2100 24 0.00000596 596 10010101002 0.6	2040	9	0.1953125	19 531 250	10010101000000101111100102	41016.
2052 12 0.02441406 2441406 10010101000000101111102 5127. 2056 13 0.01220703 1220703 1001010100000010111112 2563.5 2060 14 0.00610351 610351 10010101000000101112 1281.7 2064 15 0.00305175 305175 1001010100000010112 640.87 2068 16 0.00152587 152587 100101010000001012 320.43 2072 17 0.00076293 76293 10010101000000102 80.107 2080 19 0.00019073 19 073 1001010100000012 40.053 2084 20 0.00009536 9536 100101010000002 20.026 2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 2.5032 2100 24 0.0000596 596 10010101002 2.5032 2104 25 0.0000028 298 10010101012 0.6258	2044	10	0.09765625	9 765 625	1001010100000010111110012	20508.
2056 13 0.01220703 1220703 1001010100000010111112 2563.5 2060 14 0.00610351 610351 10010101000000101112 1281.7 2064 15 0.00305175 305175 1001010100000010112 640.87 2068 16 0.00152587 152587 100101010000001012 160.22 2076 18 0.00076293 76293 10010101000000102 80.107 2080 19 0.00019073 19073 10010101000000012 40.053 2084 20 0.00009536 9536 100101010000002 20.026 2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 5.0064 2096 23 0.0001192 1192 100101010002 1.2516 2104 2.5 0.0000298 298 1001010102 0.6258 2108 26 0.0000074 74 10010102 0.1554	2048	11	0.04882812	4 882 812	100101010000001011111002	10254.
2060 14 0.00610351 610 351 100101010000001011112 1281.7 2064 15 0.00305175 305 175 1001010100000010112 640.87 2068 16 0.00152587 152 587 100101010000001012 320.43 2072 17 0.00076293 76 293 10010101000000102 80.107 2080 19 0.00019073 19 073 1001010100000012 40.053 2084 20 0.00009536 9536 100101010000002 20.026 2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 5.0064 2096 23 0.00001192 1192 100101010002 2.5032 2100 24 0.00009596 596 10010101002 1.2516 2104 25 0.0000028 298 1001010102 0.6258 2108 26 0.0000044 74 1001012 0.1554 2116 <td>2052</td> <td>12</td> <td>0.02441406</td> <td>2 441 406</td> <td>100101010000001011111102</td> <td>5127.</td>	2052	12	0.02441406	2 441 406	100101010000001011111102	5127.
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2056	13	0.01220703	1 220 703	10010101000000101111112	2563.5
2068 16 0.00152587 152587 1001010100000010112 320.43 2072 17 0.00076293 76293 100101010000001012 160.22 2076 18 0.00038146 38146 10010101000000102 80.107 2080 19 0.00019073 19073 1001010100000012 40.053 2084 20 0.00009536 9536 100101010000002 20.026 2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 5.0064 2096 23 0.00001192 1192 100101010002 2.5032 2100 24 0.00000596 596 10010101002 1.2516 2104 25 0.00000298 298 1001010102 0.6258 2108 26 0.00000074 74 1001012 0.1554 2116 28 0.00000037 37 1001012 0.0378 2124 30	2060	14	0.00610351	610 351	1001010100000010111112	1281.7
2072 17 0.00076293 76 293 10010101010000001012 160.22 2076 18 0.00038146 38 146 10010101000000102 80.107 2080 19 0.00019073 19 073 100101010000002 40.053 2084 20 0.00009536 9536 10010101000002 20.026 2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 5.0064 2096 23 0.00001192 1192 100101010002 2.5032 2100 24 0.00000596 596 10010101002 1.2516 2104 25 0.00000298 298 1001010102 0.6258 2108 26 0.00000149 149 1001010102 0.1554 2116 28 0.00000037 37 100102 0.0378 2124 30 0.00000009 9 10012 0.0189 2128 31	2064	15	0.00305175	305 175	10010101000000101112	640.87
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2068	16	0.00152587	152 587	1001010100000010112	320.43
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2072	17	0.00076293	76 293	100101010000001012	160.22
2084 20 0.00009536 9536 100101010000002 20.026 2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 5.0064 2096 23 0.00001192 1192 100101010002 2.5032 2100 24 0.00000596 596 10010101002 1.2516 2104 25 0.00000298 298 1001010102 0.6258 2108 26 0.00000149 149 100101012 0.3129 2112 27 0.00000074 74 10010102 0.1554 2116 28 0.00000037 37 1001012 0.0378 2120 29 0.00000018 18 100102 0.0189 2124 30 0.00000009 9 10012 0.0084 2128 31 0.00000002 2 102 0.0084	2076	18	0.00038146	38 146	10010101000000102	80.107
2088 21 0.00004768 4768 10010101000002 10.013 2092 22 0.00002384 2384 1001010100002 5.0064 2096 23 0.00001192 1192 100101010002 2.5032 2100 24 0.00000596 596 10010101002 1.2516 2104 25 0.00000298 298 1001010102 0.6258 2108 26 0.00000149 149 100101012 0.3129 2112 27 0.00000074 74 10010102 0.1554 2116 28 0.00000037 37 100102 0.0378 2120 29 0.00000018 18 100102 0.0378 2124 30 0.00000009 9 10012 0.0084 2128 31 0.00000002 2 102 0.0042	2080	19	0.00019073	19 073	1001010100000012	40.053
2092 22 0.00002384 2384 10010101000002 5.0064 2096 23 0.00001192 1192 100101010002 2.5032 2100 24 0.00000596 596 10010101002 1.2516 2104 25 0.00000298 298 1001010102 0.6258 2108 26 0.00000149 149 100101012 0.3129 2112 27 0.00000074 74 10010102 0.1554 2116 28 0.00000037 37 1001012 0.0777 2120 29 0.00000018 18 100102 0.0378 2124 30 0.00000009 9 10012 0.0189 2128 31 0.00000004 4 1002 0.0084 2132 32 0.00000002 2 102 0.0042	2084	20	0.00009536	9536	100101010000002	20.026
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2088	21	0.00004768	4768	10010101000002	10.013
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2092	22	0.00002384	2384	1001010100002	5.0064
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2096	23	0.00001192	1192	100101010002	2.5032
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2100	24	0.00000596	596	10010101002	1.2516
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2104	25	0.00000298	298	1001010102	0.6258
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2108	26	0.00000149	149	100101012	0.3129
2120 29 0.00000018 18 100102 0.0378 2124 30 0.00000009 9 10012 0.0189 2128 31 0.00000004 4 1002 0.0084 2132 32 0.00000002 2 102 0.0042	2112	27	0.00000074	74	10010102	0.1554
2124 30 0.00000009 9 10012 0.0189 2128 31 0.00000004 4 1002 0.0084 2132 32 0.00000002 2 102 0.0042	2116	28	0.00000037	37	1001012	0.0777
2128 31 0.00000004 4 1002 0.0084 2132 32 0.00000002 2 102 0.0042	2120	29	0.00000018	18	100102	0.0378
2132 32 0.00000002 2 10 ₂ 0.0042	2124	30	0.00000009	9	10012	0.0189
	2128	31	0.00000004	4	1002	0.0084
2136 33 0.00000001 1 12 0.0021	2132	32	0.00000002	2	102	0.0042
	2136	33	0.00000001	1	12	0.0021

```
In[792]:=
      totalSats = Total[
         Table[
         210000 * BitShiftRight[coinbase, x]
          , {x, 0, 32}
         ]
        ]
Out[792]=
       2 099 999 997 690 000
```

In[793]:=

totalBitcoin = AccountingForm[totalSats / 100 000 000 // N, 20]

Out[793]//AccountingForm=

20999999.9769