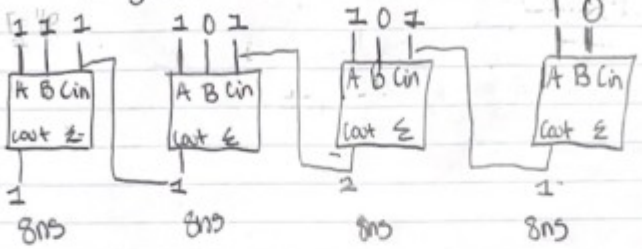
Shiker Hob
11/18/21
Phys 306

Physics 306 Midterm #2

1).



32ns is the worst case

$f = 1/T$ $f = 1/32 = .03125$ GHz

$f = 1/32ns$

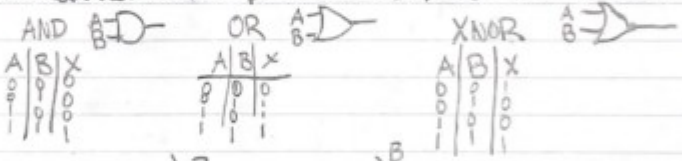
$= .03125 GHz$

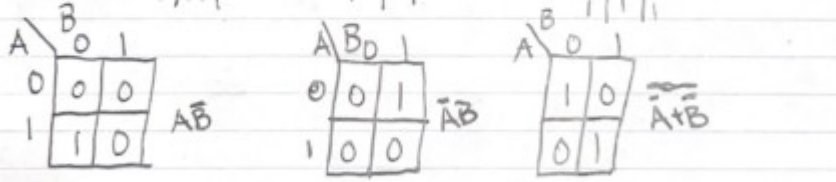
a).

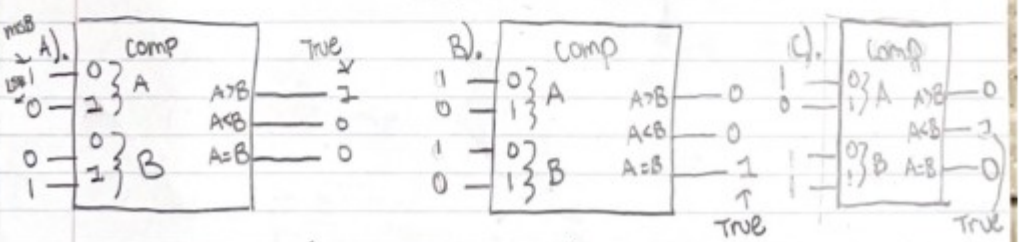
b). 1/64ns = .015625 GHz

c). * Each clock pulse in waveform is 4ns. When each sum is taking place, the timing diagram shows "HIGH". The first carry in takes place after FA1 which can be seen in the waveform. I divided the clock period to be 4ns; disregard the first pulse.

2). K-map AND OR XNOR

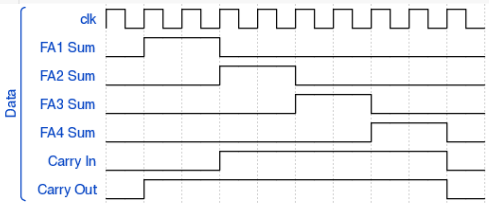




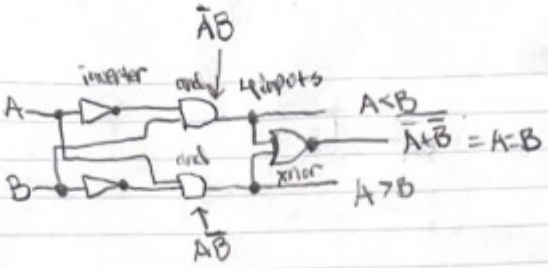


2>1 true ✓ 2=2 ✓ 2<3 ✓

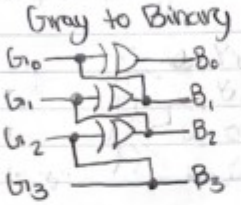
```
{ "signal" : [
  ["Data",
   { name: "clk",     wave: "p........." },

  { "name": "FA1 Sum", "wave": "lh.l......" },
  { "name": "FA2 Sum", "wave": "l..h.l...." },
   { "name": "FA3 Sum", "wave": "l....h.l.." },

   { "name": "FA4 Sum", "wave": "l......h.l" },

   { "name": "Carry In", "wave": "l..h.....l" },
   { "name": "Carry Out", "wave": "lh.......l" },



   ],
  ,
],
  "config" : { "hscale" : 1 }
}
```



D).

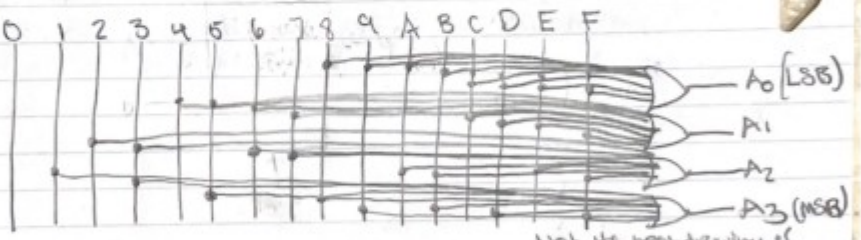


3).



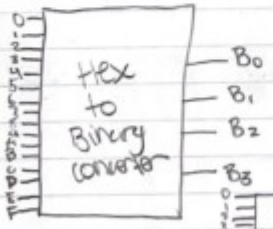
*see waveform for timing diagram

4). A)

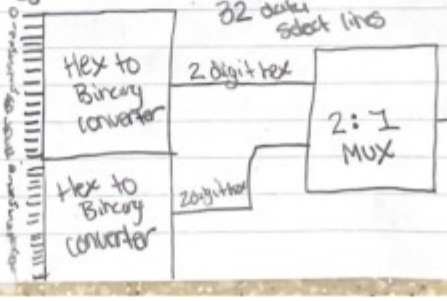


Not the best drawing :(

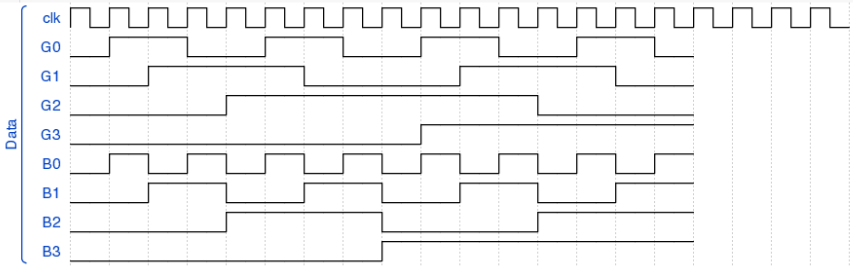
b).



C). Didn't really understand this part. Hopefully I was on the right track!



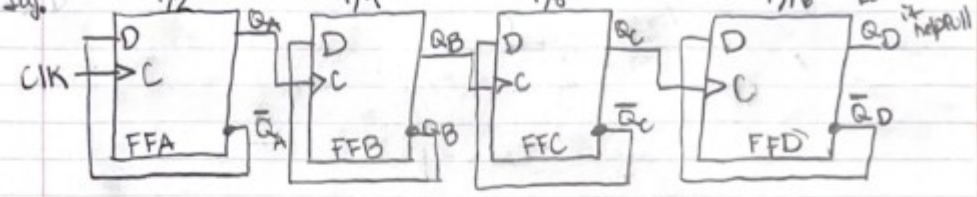
```
{ "signal" : [
  ["Data",
   { name: "clk",     wave: "p................." },

  { "name": "G0", "wave": "lh.l.h.l.h.l.h.l" },
  { "name": "G1", "wave": "l.h...l...h...l." },
   { "name": "G2", "wave": "l...h.....l..." },
   { "name": "G3", "wave": "l.......h....." },
      { "name": "B0", "wave": "lhlhlhlhlhlhlhlh" },
      { "name": "B1", "wave": "l.h.l.h.l.h.l.h." },
      { "name": "B2", "wave": "l...h...l...h..." },
      { "name": "B3", "wave": "l.....h....." },



   ],
  ,
],
 "config" : { "hscale" : 1 }
}
```



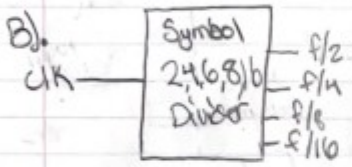
Striker Help
11/22/21

Chapter 7 Latches & Flip Flops

A). f/2 f/4 f/8 f/16 *not part of Part A but I found it helpful

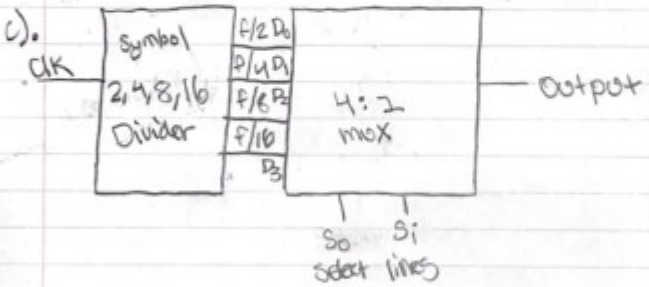


B).



* each flip flop cuts the clock frequency by two so we achieve the other two dividers simply by adding flip flops

C).

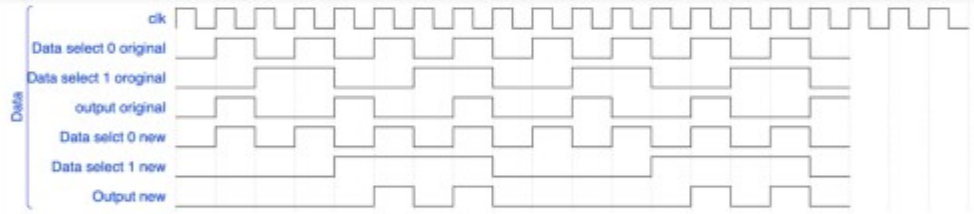


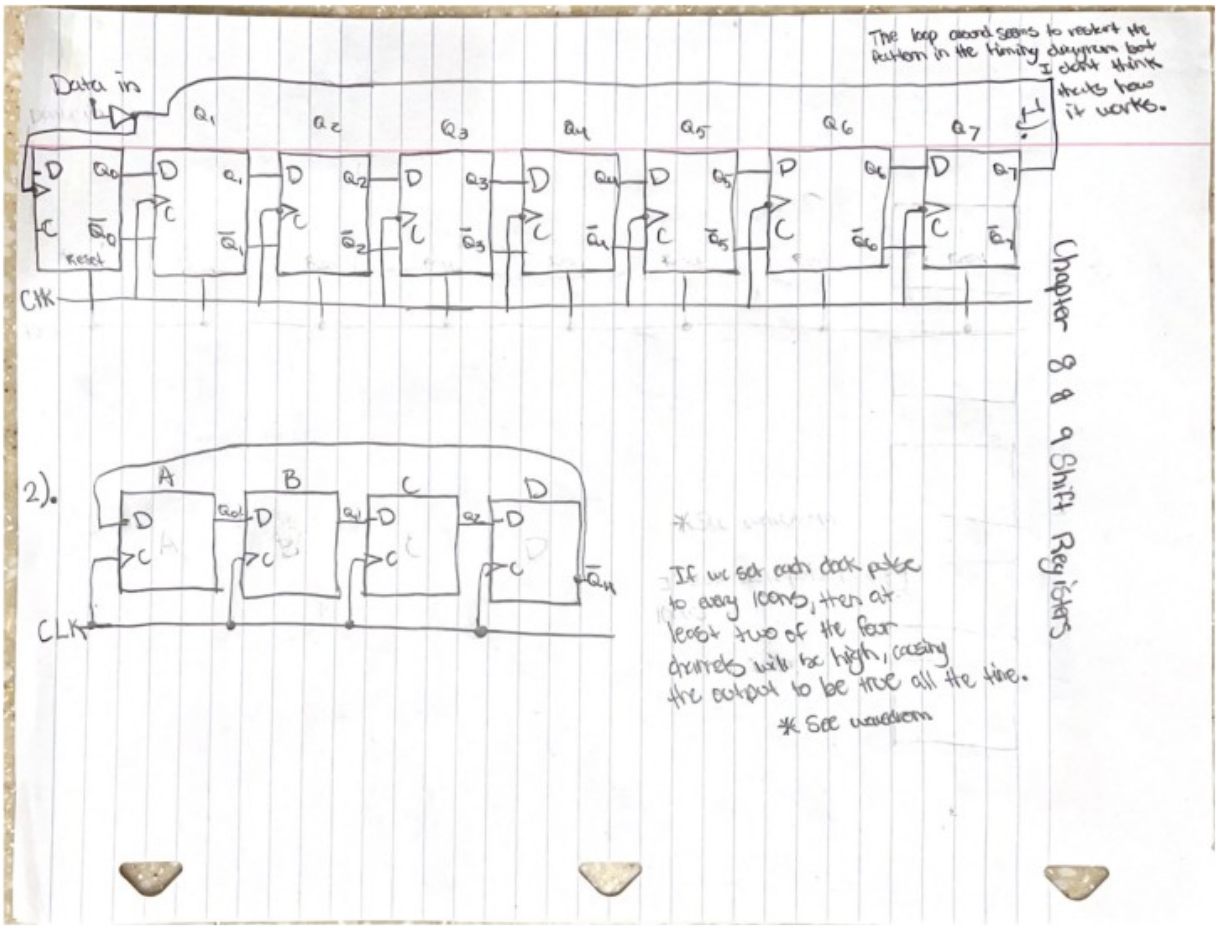
D). * See wavedrom

S_0	S_1	D
0	0	D_0 → output
0	1	D_1 → output
1	0	D_2 → output
1	1	D_3 both → output

the "output row" on wavedrom shows a different delta select lines compared to the original S_0 & S_1 & output above the new ones. Hopefully I did the right

```
{ "signal" : [
  ["Data",
   { name: "clk",     wave: "p....................." },

  { "name": "Data select 0 original", "wave": "lhlhlhlhlhlhlhlhl" },
  { "name": "Data select 1 oroginal ", "wave": "l.h.l.h.l.h.l.h.l" },
   { "name": "output original", "wave": "lhl.hl.hl.hl.hl.h" },

   { "name": "Data selct 0 new", "wave": "lhlhlhlhlhlhlhlhl" },

   { "name": "Data select 1 new", "wave": "l...h...l...h...l" },
   { "name": "Output new", "wave": "l....hlhl....hlhl" },



   ],
  ,
],
  "config" : { "hscale" : 1 }
}
```






```
{ "signal" : [
  ["Data",
   { name: "clk",     wave: "p.............." },

  { "name": "Q0", "wave": "lh...l..........." },
  { "name": "Q1", "wave": "l.h...l.........." },
   { "name": "Q2", "wave": "l..h...l........." },

   { "name": "Q3", "wave": "l...h...l........" },

   { "name": "Johnson Output", "wave": "lh.......l......." },



   ],
  ,
],
  "config" : { "hscale" : 1 }
}
```