1 The Activities of Thesis Writing

The common activity to all these strategies is that you *write* something.

1. Write about things you want to do the next day. This is especially useful if you did not do a lot of thinking or reading in the current day.

2. Write about things that you read today. Make a list of questions that you have.

3. Write a general introduction of things from memory. (This seems the hardest to do)

4. Write about what you are feeling, and how to deal with it, which may delve into Buddhism and mindfulness.

2 True Quantum Division

The first step is to reduce finding the ratio of two numbers x and y with finding the reciprocal y^{-1} with some precision (binary fraction digits). Then taking the product xy^{-1}, since we already know how to do multiplication.

So what are the steps in finding the reciprocal?

First, we know that y is less than one. I think it is not the case that y is an arbitrary number, but rather that it is a number between 1 and 2.

We do this by scaling x as $2^s y$ where s is the largest integer such that $2^s \leq y \leq 2^{s+1}$. Scaling x by 2^s, which we call x' is just bitshifting. Then $y' = y \cdot 2^{-s}$, which is just truncating bits. We assume that we have a leading one by convention.

So now we know that $1 \leq y' < 2$, and we want to find y'^{-1}, which will be $\frac{1}{2} < y'^{-1} \leq 1$. Let's say this is as easy as taking the bits of y':

$$y' = 1.y_1 y_2 y_3 y_4 \dots y_n \tag{1}$$

Every bit of y'^{-1}, let's call it z, is simply the inverse of the corresponding bit in y'.

$$z' = 0.1 \cdot (1 - y_1) \cdot (1 - y_2) \cdot (1 - y_3) \dots \tag{2}$$

FACT CHECK THIS. It seems too simplistic.

Now assume that we know the reciprocal, $z' = y'^{-1}$, we can shift it up by 2^s, which is technically part of x', and then multiply.

3 What is the Plan to Fail Softly

Do not try to understand the division algorithm, or powering, or multiplication, in detail. Instead, concentrate on the resources needed. If you have time, go back and try to understand the algorithm, or try to derive the explicit polynomial.

Do not be seduced with doing new work. Some new work might be needed in Chapter 4, when you try to simulate local Hamiltonians. That is the most fearsome part.

Finish Chapter 1, and let others give you feedback and what you need to do. Read the Harmonic Analysis paper, or at least understand better its results which are used in the depth-efficient paper, to see if you can get asymptotic bounds without knowing the explicit polynomial.

Isolate yourself from pretty girls, and social scenes where you will compete and come to focus on what you do not have, rather than on what you have.

4 The Desire for Vagueness

Often there is a sense of wanting to avoid specifics, of meeting the interface of your ignorance, by not formulating things in symbols. After all, once you have put it in symbols, you could be wrong, and you could fact check it.

Be vigilant against this. Use as many symbols as possible. Over-bias yourself towards using symbols. And formulating things, and calculating quantities.

5 Quantum Circuit Coherence

What can we state about the quantum circuit coherence and the circuits we have calculated so far? Certainly, we know that fanning-out increases coherence by a certain amount. Fanning out a qubit by n increases the circuit coherence at least by $n \cdot D$, but as $D = O(1)$, we increase the circuit coherence by a linear amount.

6 Deterrences

It is not just the fear of losing money which would make you want to keep writing thesis pages for a particular day. It is also painful to not have things to write, and so the memory of it would work on the next day for you to read, and so have something to write about.

What are the things you want to read about tomorrow? Multiplication, and how it scales up from the product of two numbers to multiple product, and its relationship to POWERING.

Print out the paper on harmonic analysis. Print out the paper on the power of small weights. Be aware of perfectionism or procrastination as deterring you from you goal of finishing, since it is often easier, even though still painful, to wallow in your not understanding of a thing than to finish it, and submit an imperfect thing. As long as you prolong the finishing, you preserve the fantasy of a future perfect thing.

When you were writing your generals exam, you made great progress in reading papers and then summarizing them, in the style of a buccaneer-scholar. Other techniques you used for isolation. You pretty much cut yourself off from other society in order to get your work done. Did you institute daily page quotas? Unknown. You definitely made it a point to sit and write for several hours at a time. Maybe you have a notebook account of the kind of work you did during this time. A lot of meditation, which you are missing this time. Because you put off the writing until the end of the day.

Not just insight into what you are doing. But also recognizing thoughts as thoughts, and behaviors of unworthiness. Three minutes to go.

Printing out and reading other papers for a timeboxed amount of time. You may have reached the limit of social pressure, where you are doing more work to uphold your social network than you are getting from it, in terms of suffering from guilt and so forth. It is not a nice way to view your life, as business transactions. How much discomfort is necessary?

7 The Threshold Circuit

Things that could affect the circuit resources of a threshold circuit. One is the number of inputs. One is the magnitude of the weights. One is the magnitude or precision of the thresholds. If, as I suspect, the weights and the thresholds are scaled angles of $0 \leq \phi \leq 2\pi$, then the precision matters, and is inversely proportional to the magnitude. Polynomially-bounded weights in the classical threshold case corresponds to inverse polynomial precision in the quantum case.

The circuit size of each threshold gate, when reduced to a 2D CCNTC model (or maybe can even make it a 1D CCNTC model) depends on the size of the gates, or the number of inputs, since this is the number that must be used in transporting the qubits using constant-depth teleportation.

8 Connecting Themes of the Current Work

Circuit coherence as a new resource for measuring time-space product and trade-offs. We need to show a separation between space on the lower bound and depth-width on the upper bound.

Mapping other addition approaches to CCNTC, like the configurable-depth Takahashi-Tani addition scheme.

The nearest-neighbor implementation of KSV compiling, or rather, using the nearest-neighbor implementation of constant-depth addition.

9 The Feeling of Retreating from Reality is Hard