CS 4400 - Problem Set 7

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1. Problem 5.21.

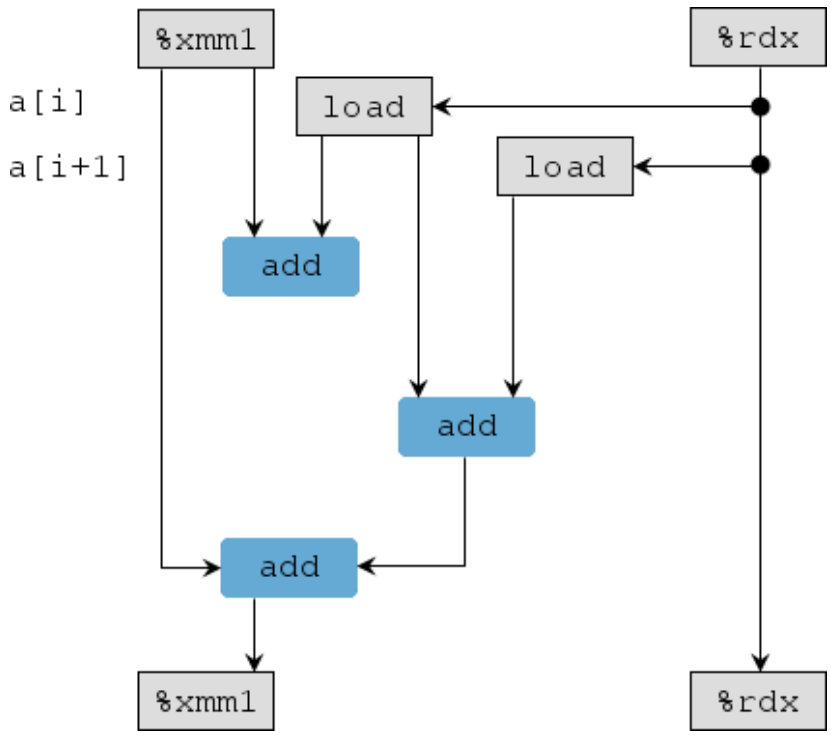
2-way loop unrolling and reassociation:

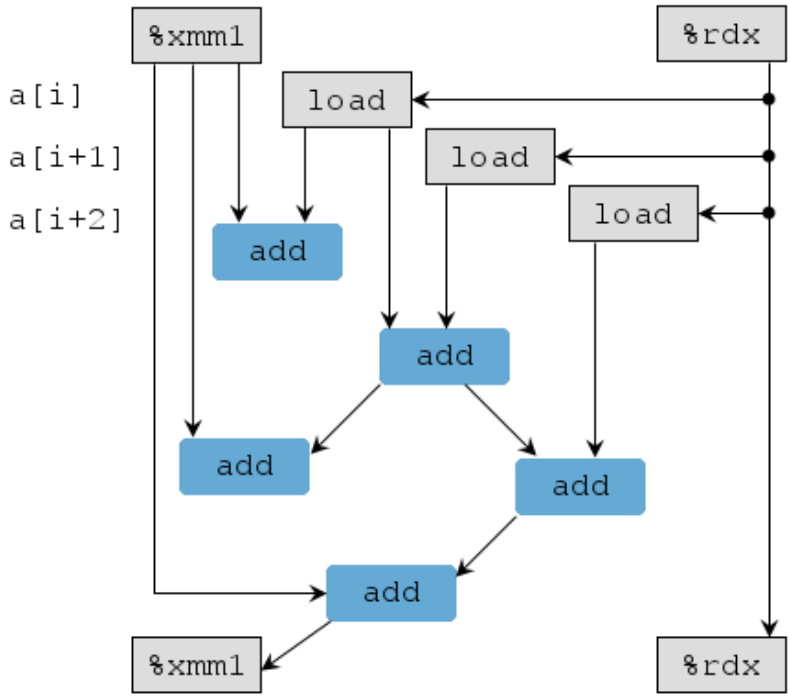
```
void psum2way(float a[], float p[], long int n)
{
      long int i;
      int limit = n - 1;
      float last_val, val;
      last_val = p[0] = a[0];
      for (i = 1; i < limit; i += 2) {
            int a_i   = a[i];
            int a_i_1 = a[i+1];
            p[i] = last_val + a_i;
            val = last_val + (a_i + a_i_1);
            p[i+1] = val;
            last_val = val;
      }

      for (; i < n; i++) {
            val  = last_val + a[i];
            p[i] = val;
            last_val = val;
      }
}
```

3-way loop unrolling and reassociation:

```
void psum3way(float a[], float p[], long int n)
{
      long int i;
      int limit = n - 2;
      float last_val, val;
      last_val = p[0] = a[0];
      for (i = 1; i < limit; i += 3) {
            int a_i   = a[i];
            int a_i_1 = a[i+1];
            int a_i_2 = a[i+2];
            p[i] = last_val + a_i;
            p[i+1] = last_val + (a_i + a_i_1);
            val = last_val + (a_i + (a_i_1 + a_i_2));
            p[i+2] = val;
            last_val = val;
      }

      for (; i < n; i++) {
            val  = last_val + a[i];
            p[i] = val;
            last_val = val;
      }
}
```

2. Data flow diagrams for my solutions to 5.21:





3. Problem 5.22: Improving part B would provide a speedup of 1.25, while improving part C would only provide a speedup of 1.20. Thus, speeding up part B would be a better choice for maximizing performance. However, my going rate is $10,000 for this kind of speedup. ☺

4. Problem 6.27:

Cache	m	C	B	E	S	t	s	b
1.	32	2048	8	1	256	21	8	3
2.	32	2048	4	4	128	23	7	2
3.	32	1024	2	8	64	25	6	1
4.	32	1024	32	2	16	23	4	5