## Homework 1

1. 某台计算机执行标准测试程序,程序中指令类型、出现频率,需要时钟周期如下:

指令类型	指令出现频率	需要时钟周期数
ALU	35%	1
Load	25%	2
Store	15%	2
Branch	25%	3

- 1.1 计算CPI
- 1.2 我们观察到35%的ALU操作都伴随着一条load指令。现在我们用一条新的指令来替代这些ALU操作和与之对应的load操作,这条新指令的执行需要花费1个时钟周期。加入这条指令后,branches需要花费5个时钟周期。请计算新版本的CPI
- 1.3 如果新版本的时钟周期时间是旧版本的1.2倍,那么哪个版本的CPU执行时间更短?
- 2. 公司刚刚买了一个新的 Intel Core i5 四核处理器,你接到针对这一处理器来优化软件的任务。你将在这个处理器上运行两个应用程序,但它们的资源需求并不一样。第一个程序需要 60% 的处理器计算资源,另一个需要 40%的处理器计算资源。假定对该程序的一部分进行并行化时,该部分的加速比为 2【请注意多核与多处理器的区别】
- 2.1 假定第一个应用程序的 80%可以并行化,那么在隔离运行时,通过这个应用程序可以实现多大的加速比?
- 2.2 假定第二个应用程序的 30%可以并行化,那么在隔离运行时,通过这个应用程序可以实现多大的加速比?
- 2.3 假定第一个应用程序的 80%可以并行化,如果对其实现并行化,系统总加速比为多少?
- 2.4 假定第二个应用程序的 30%可以并行化,如果对其实现并行化,系统总加速比为多少?
- 3. Server farms such as Google, Amazon and Alibaba provide enough compute capacity for the highest request rate of the day. Imagine that most of the time these servers operate at only 60% capacity. Assume further that the power does not scale linearly with the load; that is, when the servers are operating at 60% capacity, they consume 90% of maximum power. The servers could be turned off, but they would take too long to restart in response to more load. A new system has been proposed that allows for a quick restart but requires 10% of the maximum power while in this "barely alive" state.
- 3.1. How much power savings would be achieved by placing 30% of the servers in the "barely alive" state and 30% off?
- 3.2 How much power savings would be achieved by reducing the voltage by 30% and frequency by 50%?