RESEARCH AND READING ASSIGNMENT

A) [10] [Max 1 page] Read the paper labeled R4a and comment on it, providing a short summary of the focus of the paper and their key arguments, and answer the following questions.
   a. Which applications would benefit most from the VLIW architectures?
   b. Is it suitable for desktop computers, or mobile devices?

B) [10] Read paper labeled with R4b and comment on it. Make sure to specifically address these points:
   a. What assumptions were made about computer organization before adding SMT?
   b. How does it compare to Wall's claims of ILP limits?
   c. What changes were made to add SMT?
   d. What performance advantages are claimed? For what workloads?

C) [10] The Top 500 list categorizes the fastest scientific machines in the world accounting to their performance on the Linpack benchmarks. Visit the web site www.top500.org (also the page under the statistics tab).
   a. Name the most dominant architecture and operating system.
   b. List the imperative characteristics of two machines (ranking among top ten) in a table format.

EXERCISES

1) [40] Short answers

   a) [10] Why might speculation and prediction be of less value in the embedded computer marketplace than in the server or desktop arena? What are the market niches where they will be least valued?

   b) [10] Hardware multithreading is to increase the utilization of resources on a chip by allowing multiple threads to share the functional units of a single processor. Briefly describe the advantages and disadvantages of fine-grain multithreading.

   c) [10] Briefly describe the advantages and disadvantages of simultaneous multithreading (SMT).

   d) [10] For each type of parallelisms: instruction-level parallelism, data-level parallelism, and thread-level parallelism, list at least 3 different kinds of applications that will benefit from.

2) [30] In this exercise, we will examine several loops and analyze their potential for parallelization.

a. [10] Does the following loop have a loop-carried dependency?

```
for (i=0; i<100; i++) {
   A[i] = B[2*i+4];
   B[4*i+5] = A[i];
}
```

b. [10] In the following loop, find all the true dependences, output dependences, and antidependences. Eliminate the output dependences and antidependences by renaming.

```
for (i=0; i<100; i++) {
   A[i] = A[i] * B[i]; /* S1 */
   B[i] = A[i] + c; /* S2 */
   A[i] = C[i] * c; /* S3 */
   C[i] = D[i] * A[i]; /* S4 */
}
```

c. [10] Consider the following loop:

```
for (i=0; i < 100; i++) {
   A[i] = A[i] + B[i]; /* S1 */
   B[i+1] = C[i] + D[i]; /* S2 */
}
```

Are there dependences between S1 and S2? Is this loop parallel? If not, show how to make it parallel.