Otto-von-Guericke-University Magdeburg
Max Planck Institute for Dynamics of Complex Technical Systems
Computational Methods in Systems and Control Theory

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Website: http://www.mpi-magdeburg.mpg.de/csc/teaching/20ws/sc1/

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Scientific Computing 1
3rd worksheet for online events
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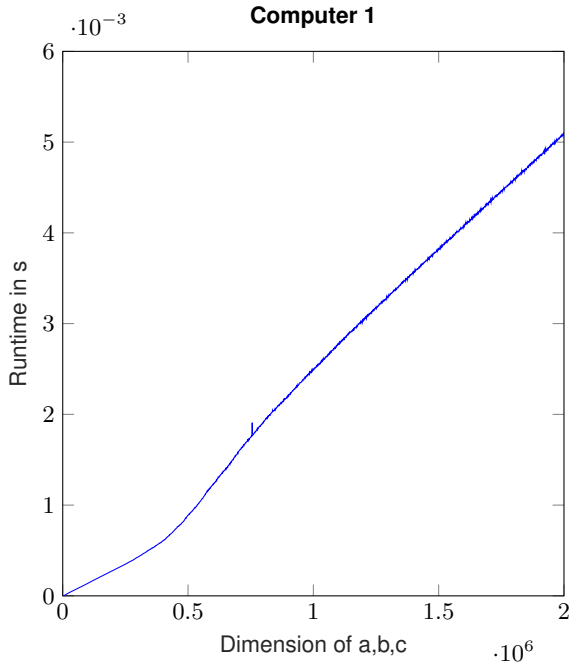
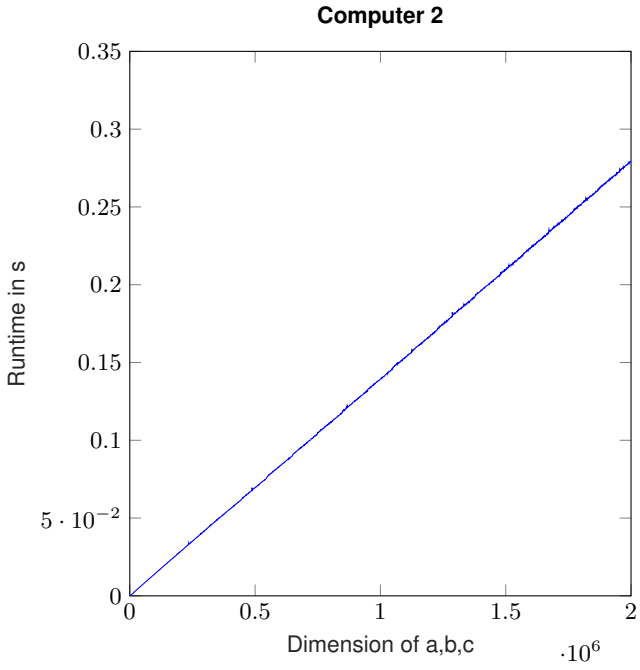
Exercise 1:

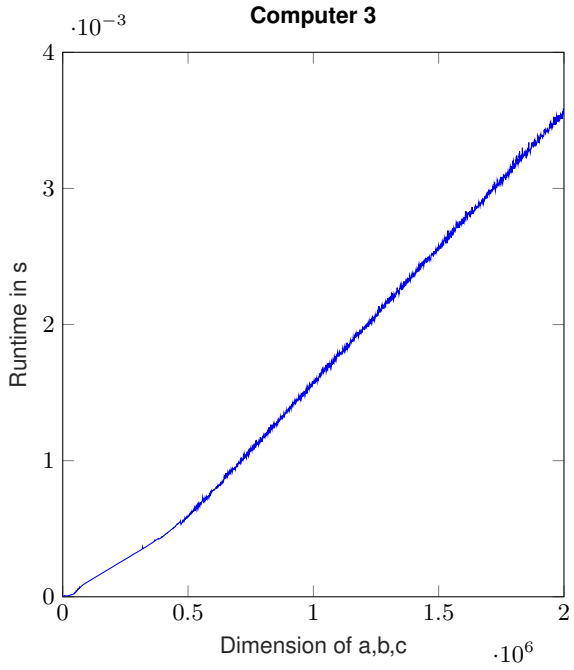
We consider the following C function:

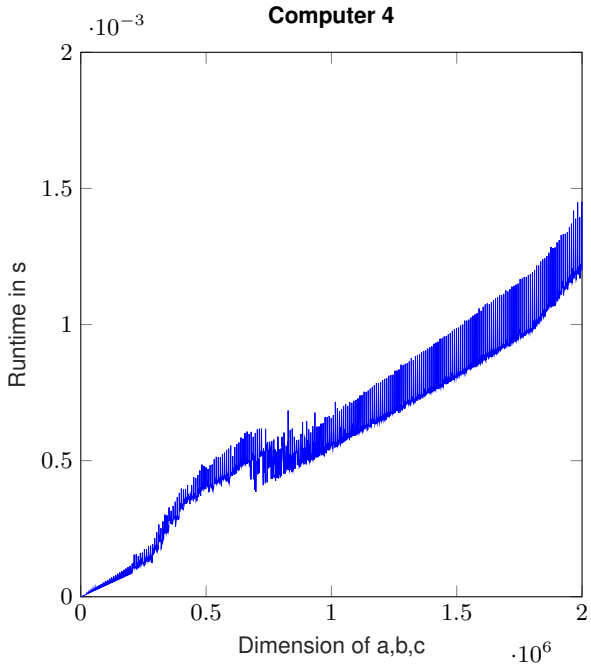
```
void axpy(int n, double *a, double *b, double *c) {
 int i;
 for ( i = 0 ; i < n ; i++){
  c[i]=a[i]+b[i];
 }
}
```

computing $c = a + b$ with $a, b, c \in \mathbb{R}^n$. We ran this for various $n \in \{1000, 2000, \ldots, 2 \cdot 10^6\}$ and took the average time for one vector add operation. On four different computers we got the following plots:









What can you recognize in the plots? Explain this behavior. Is it possible to determine any details of the memory hierarchy? Why is the runtime not linear?

Hint: The complete source of the benchmark program is available at: `http://www2.mpi-magdeburg.mpg.de/mpcsc/lehre/2018_WS_SC/tutorial/axpy.c`