Computing DFT using Brute Force versus computing it using the FFT

In[1]:=

n=4;

```
In[2]:= n = 4;
In[3]:= A = Table[RandomReal[], {n, 1, n}];
```

In[4]:= $\texttt{Timing}\left[\frac{1}{\sqrt{n}}\left(\texttt{Table}\left[e^{i\,2\,\pi\,\frac{k}{n}\,m}, \{k, 0, n-1\}, \{m, 0, n-1\}\right].A\right)\right][[1]]$

```
Out[4]= 0.000161
In[5]:= Timing[Fourier[A]][[1]]
Out[5]= 0.001967
```

n=16;

```
In[6]:= n = 16;
In[7]:= A = Table[RandomReal[], {n, 1, n}];
```

In[8]:= $\texttt{Timing}\left[\frac{1}{\sqrt{n}}\left(\texttt{Table}\left[e^{i\,2\,\pi\,\frac{k}{n}\,m}, \{k, 0, n-1\}, \{m, 0, n-1\}\right].A\right)\right][[1]]$

```
Out[8]= 0.001608
In[9]:= Timing[Fourier[A]][[1]]
Out[9]= 0.000058
```

n=64;

```
In[10]:= n = 64;
In[11]:= A = Table[RandomReal[], {n, 1, n}];
```

In[12]:= $\texttt{Timing}\left[\frac{1}{\sqrt{n}}\left(\texttt{Table}\left[e^{i\,2\,\pi\,\frac{k}{n}\,m}, \{k, 0, n-1\}, \{m, 0, n-1\}\right].A\right)\right][[1]]$

```
Out[12]= 0.032856
In[13]:= Timing[Fourier[A]][[1]]
Out[13]= 0.000068
```

n=256;

In[14]:= `n = 256;`

In[15]:= `A = Table[RandomReal[], {n, 1, n}];`

In[16]:= $\texttt{Timing}\left[\frac{1}{\sqrt{n}}\left(\texttt{Table}\left[e^{i\,2\,\pi\,\frac{k}{n}\,m},\ \{k,\ 0,\ n-1\},\ \{m,\ 0,\ n-1\}\right].A\right)\right][[1]]$

Out[16]= 1.18607

In[17]:= `Timing[Fourier[A]][[1]]`

Out[17]= 0.000438

n=1024;

In[18]:= `n = 1024;`

In[19]:= `A = Table[RandomReal[], {n, 1, n}];`

In[20]:= $\texttt{Timing}\left[\frac{1}{\sqrt{n}}\left(\texttt{Table}\left[e^{i\,2\,\pi\,\frac{k}{n}\,m},\ \{k,\ 0,\ n-1\},\ \{m,\ 0,\ n-1\}\right].A\right)\right][[1]]$

Out[20]= 9.04113

In[21]:= `Timing[Fourier[A]][[1]]`

Out[21]= 0.000094

n=4096;

In[22]:= `n = 4096;`

In[23]:= `A = Table[RandomReal[], {n, 1, n}];`

In[24]:= $\texttt{Timing}\left[\frac{1}{\sqrt{n}}\left(\texttt{Table}\left[e^{i\,2\,\pi\,\frac{k}{n}\,m},\ \{k,\ 0,\ n-1\},\ \{m,\ 0,\ n-1\}\right].A\right)\right][[1]]$

Out[24]= 134.817

In[25]:= `Timing[Fourier[A]][[1]]`

Out[25]= 0.001285