

Data Structures BCS-4F  
FAST-NU, Lahore, Spring 2021

Homework 2

Step Count Analysis and Asymptotic Notation

Due Fri April 9, 2021 11:59PM

**Ungraded but submission is required**

Perform step-count analysis on the following code fragments. Indicate the time taken by each line of code over the lifetime of the program, then add all individual times to get  $T(n)$ . Where applicable, work in the worst case scenario. Then find a  $\theta(f(n))$  for each  $T(n)$ . In order to do this, you must establish that there exist constants  $c, d > 0$ , such that  $cf(n) \leq T(n) \leq df(n)$ , for all  $n \geq n_0$

<p>1.</p> <pre> int s, i, n; cin &gt;&gt; n; s = 0; for (i = n; i &gt;= 1; i--)     s++; </pre>	<p>5.</p> <pre> int i, j, sum, n; cin &gt;&gt; n; for (i = 1; i &lt;= n; i = i * 2) {     cout &lt;&lt; i;     sum = 0;     for (j = 1; j &lt;= i; j = j * 2)     {         Sum++;         cout &lt;&lt; i;     }     cout &lt;&lt; Sum; } </pre>
<p>2.</p> <pre> int sum, i, j, k, n; sum = 0; k = 0; cin &gt;&gt; n; for (i = 0; i &lt; n; ++i) {     k = 0;     sum++;     for (j = n; j &gt; 0; j = j - 3)     {         sum++;         k = k * sum;         cout &lt;&lt; k;     }     cout &lt;&lt; k; } </pre>	<p>6.</p> <pre> int i, j, sum, n; sum = 0; cin &gt;&gt; n; for (i = n; i &gt;= 1; i = i / 5) {     cout &lt;&lt; i;     cout &lt;&lt; sum;     for (j = 1; j &lt;= i; ++j)     {         cout &lt;&lt; j;         cout &lt;&lt; "*";         sum++;     }     sum = 0; } </pre>
<p>3.</p> <pre> int sum, i, j, n; sum = 0; cin &gt;&gt; n; for (i = 1; i &lt; n; i = i * 2)     for (j = 1; j &lt; n; j = j * 2) </pre>	

<pre>sum++;</pre>	
<pre>4.  int sum,i,j,k,n;     sum = 0;     cin&gt;&gt;n;      for (i=1;i&lt;n;i=i*2)     {      for (j=0;j&lt;n;++j)             for (k=1;k&lt;=n;k=k*2)                  sum++;     }</pre>	<pre>7.  //A is an array containing nums 1...n     //on positions 1 ...n     //this code replaces all the non-primes by -1     int i, k;     A[1] = -1;     for(i=2; i&lt;=n; i++)         for(k=2; k*i&lt;=n; k++)             A[k*i] = -1;</pre> <p>Hint: recall the harmonic series</p>

<pre>8.  int GCD(int n, int m){     int min;     if(n&lt;m)         min = n;     else         min = m;     for(int i=min; i&gt;1; i--)         if(n % i ==0 &amp;&amp; m % i==0)             return i;      return 1; }</pre>	<pre>9.  void binary(int num, int arr[], int &amp;bits) {     int temp = num;     bits = 0;     while(temp&gt;0){         temp = temp/2;         bits++;     }      int i = bits-1;     while(num &gt; 0){         arr[i] = num%2;         i--;         num = num/2;     } }</pre>
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**THE END**