ITRW 222

MEMO TEST 2

Vraag 1/ *Question 1* (25)

1.1 Gebruik die τ - notasie **om die looptyd** van die volgende programlyne te bepaal. (15)	*1.1 Use* τ *- notation to determine* ***the running time*** *of the following program lines (15)*

```
1.  for  ( int i=0; i<=(n+1); i++) {
2.       b=arr[i]+1; }
```

1a. $t_{fetch} + t_{store}$ √√

1b. $(3t_{fetch} + t_{<} + t_{+})$ √√ $(n+3)$ √√ $=3t_{fetch}\,n + t_{<}\,n + t_{+}n + 9t_{fetch} + 3t_{<} + 3t_{+}$

1c. $(2t_{fetch} + t_{+} + t_{store})$ √√ $(n+2)$ √√ $=2t_{fetch}n + t_{+}n + t_{store}\,n + 4t_{fetch} + 2t_{+} + 2t_{store}$

2. $(4t_{fetch} + t_{+} + t_{store} + t_{[.]})$√√ $(n+2)$ √$=4t_{fetch}n + t_{+}n + t_{store}\,n + t_{[.]}n + 8t_{fetch} + 2t_{+} + 2t_{store} + 2t_{[.]})$

Total: $9t_{fetch}n + 3t_{+}n + 2t_{store}\,n + t_{[.]}n + t_{<}\,n + 22t_{fetch} + 7t_{+} + 5t_{store} + 2t_{[.]} + 3t_{<}$ √√

1.2 Bepaal die looptyd van al <u>drie dele van lyn 8</u> in konteks van hierdie programdeel. Jy hoef nie die uitdrukkings te vereenvoudig nie. Maak gebruik van die vereenvoudigde model. (8)	*1.2 . Determine the running time of <u>all three parts of line 8</u> in context of this program segment. You need not simplify the expressions. Use the simplified model. (8)*

```
1       public class Question1.2
2       {
3         public static int numbers (int n)
4         {
5         int prod = 1;
6         for (int i=1;  i<n;  i++ )
7           {
8             for ( int j=1;  j<i; ++j)
9                prod *= (j+2)j;
10          }
11         return prod;
12       }
13      }
```

8a $2(n-1)$√ √

8b $3\sum_{i=1}^{n-1}(i)$ √√√

8c $4\sum_{i=1}^{n-1}(i-1)$ √√√

1.3 Gee die bewys van die vergelyking (2)	*1.3.* Give proof for the following equation (2)

$$\sum_{i=1}^{n}(i) = \frac{n(n+1)}{2}$$

$\sum_{i=1}^{n}(i) = 1+2+3+....+(n-2)+(n-1)+n$ but the following is also true √

$\sum_{i=1}^{n}(i) = n+(n-1)+(n-2)+...+1+2+3$ if you add these lines together – you get=√

$$\sum_{i=1}^{n}(i) = (n+1)+(n+1)+(n+1)+...+(n+1)+(n+1)+(n+1) \checkmark$$

there are n pairs of (n+1) √

$2\sum_{i=1}^{n}(i) = n(n+1)$ - after dividing each side by 2: √

$\sum_{i=1}^{n}(i) = \frac{n(n+1)}{2}$ which proves the equation

4 Gebruik die vergelyking van vraag 3 om die volgende uitdrukking te vereenvoudiging: (7)	*4. Use the equation in Question 3 to simplify the following expression: (7)*

$$2\sum_{i=0}^{n-2}(i+2)$$

$$2\sum_{i=0}^{n-2}(i+2)$$

$$= 2[\sum_{i=0}^{n-2} i + \sum_{i=0}^{n-2} 2] \checkmark$$

$$= 2[0 + \sum_{i=1}^{n} i - (n-1) - (n) + 2\sum_{i=0}^{n-2} 1] \checkmark\checkmark$$

$$= 2[0 + \frac{n(n+1)}{2} - (n-1) - (n) + 2\sum_{i=0}^{n-2} 1] \checkmark\checkmark$$

$$= 2[\frac{n(n+1)}{2} - 2n + 1 + 2(n-1)] \checkmark$$

$$= 2[\frac{n(n+1)}{2} - 2n + 1 + 2n - 2)]$$

$$= 2[\frac{n(n+1)}{2} - 1]$$

$$= 2[\frac{n(n+1) - 2}{2}]$$

$$= 2[\frac{n^2 + n - 2}{2}]$$

$= n^2 + n - 2$ √