Classes List:

**Character class, Header: 12 Bytes**

|  |  |  |  |
| --- | --- | --- | --- |
| Fields | Data type | comment | Size(Bytes) |
| unicode | Integer |  | 4 |
| **Total** | **16 bytes** |  |  |

**CharacterFactory class, Header: 12 Bytes**

|  |  |  |  |
| --- | --- | --- | --- |
| Fields | Data type | comment | Size (Bytes) |
| characterMap | HashMap <java.lang.Character, Character> | Map+Nodes+Node reference | 48+(32+18+6padding)\*N+4\*N |
|  | 🡪 char(Java) |  | 2 |
|  | 🡪 Character |  | 16 |
| **Total** | **48+60\*N** |  |  |

**Font class, Header: 12 Bytes**

|  |  |  |  |
| --- | --- | --- | --- |
| Fields | Data type | comment | Size (Bytes) |
| name | String |  | 56+N\*2 |
| size | Integer |  | 4 |
| style | Enum | reference | 4 |
| **Total** | **Depend on elements** |  |  |

**FontKeyclass, Header: 12 Bytes**

|  |  |  |  |
| --- | --- | --- | --- |
| Fields | Data type | comment | Size (Bytes) |
| name | String |  | 56+N\*2 |
| size | Integer |  | 4 |
| style | Enum |  | 4 |
| **Total** | **Depend on elements** |  |  |

**FontFactory class, Header: 12 Bytes**

|  |  |  |  |
| --- | --- | --- | --- |
| Fields | Data type | comment | Size (Bytes) |
| fontMap | HashMap<FontKey, Font> | Map+Nodes+Node reference | 48+(32+ (20+(56\*Name) + 20+(56\*Name)) )\*N+4\*N |
|  | 🡪 FontKey |  | 20+(56\*Name) bytes |
|  | 🡪 Font |  | 20+(56\*Name) bytes |
| **Total** | **Depend on elements** |  |  |

**RunArray class, Header: 12 Bytes**

|  |  |  |  |
| --- | --- | --- | --- |
| Fields | Data type | comment | Size (Bytes) |
| indexList | ArrayList <int[2]> | ArrayList+ Header+reference+data | 24+16+N\*4+(int[2])\*N |
|  | 🡪 int[2] | Header+reference+2\*int | 24+2\*4+2\*4=40 |
| fontList | ArrayList <Font> | ArrayList+ Header+reference+data | 24+16+N\*4+(Reference of Font)\*N |
|  | 🡪 Font | Font class | 20+(56\*Name) bytes |
| currentLength | int |  | 4 |
| **Total** | **Depend on elements** |  |  |

Evaluation:

**Using Flyweight:**

Text information:

1. Character number: 54
2. Two Fonts: i. (“Times”, 12, Font.NORMAL), ii. (“Times”, 14, Font.BOLD

Variables used:

1. One ArrayList
2. One CharacterFactory
3. One RunArray variable

Memory usage:

1. CharacterFactory with 54 characters:

48+60\*54 = 48+54\*54 = 3288 Bytes

1. FontFactory with two Fonts:
   1. Font: 20+(56+2\*”Times”) = 86 + 2 Padding = 88 Bytes
   2. FontKey: 20+(56+2\*”Times”) = 86 + 2 Padding = 88 Bytes
   3. Total: 48+( 32+88+88) \*2 + 4\*2 = 476 bytes
2. RunArray with 2 int [2], a length, and 2 references of Fonts:
3. A List has [0,143] and [144, 212]: 40+44\*2 = 128bytes
4. A List has 2 references of Fonts: 40+8\*2 = 56bytes
5. A integer for length=4Bytes
6. Total memory usage: 128+56+4+4padding = 192 Bytes
7. ArrayList with 356 reference of character:

40+356\*(element reference=4) +356\*(Character reference=4) = 2,888 Bytes

1. Total Memory usage: 3288+476+192+2888 = 6,844 Bytes

**Without using Flyweight:**

Variables used: Two ArrayLists: One for character, one for font

Memory usage:

1. A list contains 356 characters: 40+356\*4(reference)+356\*2(char) = 2,176 Bytes
2. A list contains 356 Fonts: 40+356\*4(reference)+356\*88(Font) = 33,504 Bytes
3. Total Memory usage: 2176+33504 = 35,680 Bytes

**Difference between two programs:**

Used: 6,836 Bytes

Without: 35,680 Bytes

Using flyweight can reduce the memory usage.