Algorithm analysis, Selection Sort

Instruction	Cost	# Repeat
ArrayList<Game> list = c.getWishList();	c_1	1
for (int i = 0; i < list.size(); i++)	c_2	$n+1$
Game minor = list.get(i);	c_3	n
int cual = i;	c_4	n
for (int j = i + 1; j < list.size(); j++)	c_5	$\frac{n(n+1)}{2}-(n-1)$
Shelve s1 = searchShelve(list.get(i).getShelveName());	c_6	$\frac{n(n+1)}{2}-n$
Shelve s2 = searchShelve(list.get(j).getShelveName());	c_7	$\frac{n(n+1)}{2}-n$
if (s1.getNameShelve().compareTo(s2.getNameShelve()) == 0)	c_8	$\frac{n(n+1)}{2}-n$
if (s2.getGameShelve().getIndexInTable(list.get(j).getCode()) < s1.getGameShelve() .getIndexInTable(list.get(i).getCode()))	c_9	$\frac{n(n+1)}{2}-n$
minor = list.get(j);	c_{10}	$\frac{n(n+1)}{2}-n$
cual = j;	c_{11}	$\frac{n(n+1)}{2}-n$
else if (s1.getNameShelve().compareTo(s2.getNameShelve()) > 0)	c_{12}	$\frac{n(n+1)}{2}-n$
Game temp1 = list.get(i);	c_{13}	$\frac{n(n+1)}{2}-n$
list.set(i, list.get(j));	c_{14}	$\frac{n(n+1)}{2}-n$
list.set(j, temp1);	c_{15}	$\frac{n(n+1)}{2}-n$
Game temp2 = list.get(i);	c_{16}	n
list.set(i, minor);	c_{17}	n
list.set(cual, temp2);	c_{18}	n
c.setWishList(list);	c_{19}	1

Note: We assume that $n = list.size$

Analysis of time complexity

$$T(n) = c_1 + c_2(n+1) + c_3 n + c_4 n + c_5\left(\frac{n(n+1)}{2} - (n-1)\right) + c_6\left(\frac{n(n+1)}{2} - n\right) + c_7\left(\frac{n(n+1)}{2} - n\right) + c_8\left(\frac{n(n+1)}{2} - n\right) + c_9\left(\frac{n(n+1)}{2} - n\right) + c_{10}\left(\frac{n(n+1)}{2} - n\right) + c_{11}\left(\frac{n(n+1)}{2} - n\right) + c_{12}\left(\frac{n(n+1)}{2} - n\right) + c_{13}\left(\frac{n(n+1)}{2} - n\right) + c_{14}\left(\frac{n(n+1)}{2} - n\right) + c_{15}\left(\frac{n(n+1)}{2} - n\right) + c_{16}n + c_{17}n + c_{18}n + c_{19}$$

$$T(n) = c_1 + c_2 + c_2 n + c_3 n + c_4 n + c_5 + \frac{c_5 n^2 - c_5 n + c_6 n^2 - c_6 n + c_7 n^2 - c_7 n + c_8 n^2 - c_8 n + c_9 n^2 - c_9 n + c_{10} n^2 - c_{10} n + c_{11} n^2 - c_{11} n}{2} + \frac{c_{12} n^2 - c_{12} n + c_{13} n^2 - c_{13} n + c_{14} n^2 - c_{14} n + c_{15} n^2 - c_{15} n}{2} + c_{16}n + c_{17}n + c_{18}n + c_{19}$$

$$T(n) = n^2\left(\frac{c_5}{2} + \frac{c_6}{2} + \frac{c_7}{2} + \frac{c_8}{2} + \frac{c_9}{2} + \frac{c_{10}}{2} + \frac{c_{11}}{2} + \frac{c_{12}}{2} + \frac{c_{13}}{2} + \frac{c_{14}}{2} + \frac{c_{15}}{2}\right) + n\left(c_2 + c_3 + c_4 - \frac{c_5}{2} - \frac{c_6}{2} - \frac{c_7}{2} - \frac{c_8}{2} - \frac{c_9}{2} - \frac{c_{10}}{2} - \frac{c_{11}}{2} - \frac{c_{12}}{2} - \frac{c_{13}}{2} - \frac{c_{14}}{2} - \frac{c_{15}}{2} + c_{16} + c_{17} + c_{18}\right) + (c_1 + c_2 + c_5 + c_{19})$$

Assuming that

$$k = \frac{c_5}{2} + \frac{c_6}{2} + \frac{c_7}{2} + \frac{c_8}{2} + \frac{c_9}{2} + \frac{c_{10}}{2} + \frac{c_{11}}{2} + \frac{c_{12}}{2} + \frac{c_{13}}{2} + \frac{c_{14}}{2} + \frac{c_{15}}{2}$$

$$y = c_2 + c_3 + c_4 - \frac{c_5}{2} - \frac{c_6}{2} - \frac{c_7}{2} - \frac{c_8}{2} - \frac{c_9}{2} - \frac{c_{10}}{2} - \frac{c_{11}}{2} - \frac{c_{12}}{2} - \frac{c_{13}}{2} - \frac{c_{14}}{2} - \frac{c_{15}}{2} + c_{16} + c_{17} + c_{18}$$

$$z = c_1 + c_2 + c_5 + c_{19}$$

We have that

$$T(n) = n^2(k) + n(y) + z \rightarrow \boldsymbol{\theta(n^2)}$$

Spatial complexity analysis

Type	Variable	Size of 1 atomic value	Amount values
Input	List	32 bits	1
Auxiliar	Minor	32 bits	1
Auxiliar	Cual	32 bits	1
Auxiliar	S1	32 bits	1
Auxiliar	S2	32 bits	1
Auxiliar	Temp1	32 bits	1
Auxiliar	Temp2	32 bits	1

- Total Spatial Complexity $= Input + Auxiliary + Output = 7 = \theta(7)$
- Auxiliary Spatial Complexity $= 6 = \theta(6)$
- Auxiliary Spatial Complexity Output $= Auxiliary + Output = 6 = \theta(6)$