Table 1: Statistical comparison between each pair of `CRAG` configurations in terms of *#fail*. (Legend. ≡: no significant difference between the two approaches. ✓: the approach on the row is *better* than the one on column, ✗ means that it is worse; the number of symbols identifies the strength of the difference: *negligible* (✓, ✗), *small* (✓✓, ✗✗), *medium* (✓✓✓, ✗✗✗), *large* (✓✓✓✓, ✗✗✗✗))

(a) Random search

| | $S4N4M4RS_{min}0.2RS_{max}1.5$ | $S4N4M4RS_{min}0.2RS_{max}2$ | $S4N4M4RS_{min}0.6RS_{max}1.5$ | $S4N4M4RS_{min}0.6RS_{max}2$ | $S4N4M5RS_{min}0.2RS_{max}1.5$ | $S4N4M5RS_{min}0.2RS_{max}2$ | $S4N4M5RS_{min}0.6RS_{max}1.5$ | $S4N4M5RS_{min}0.6RS_{max}2$ | $S5N5M4RS_{min}0.2RS_{max}1.5$ | $S5N5M4RS_{min}0.2RS_{max}2$ | $S5N5M4RS_{min}0.6RS_{max}1.5$ | $S5N5M4RS_{min}0.6RS_{max}2$ | $S5N5M5RS_{min}0.2RS_{max}1.5$ | $S5N5M5RS_{min}0.2RS_{max}2$ | $S5N5M5RS_{min}0.6RS_{max}1.5$ | $S5N5M5RS_{min}0.6RS_{max}2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S4N4M4RS_{min}0.2RS_{max}1.5$ | – | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M4RS_{min}0.2RS_{max}2$ | ≡ | – | ✗✗✗✗ | ≡ | ✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M4RS_{min}0.6RS_{max}1.5$ | ✓✓✓ | ✓✓✓✓ | – | ✓✓✓ | ≡ | ✓✓✓✓ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ |
| $S4N4M4RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ✗✗✗ | – | ≡ | ≡ | ✗✗✗ | ≡ | ✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.2RS_{max}2$ | ≡ | ≡ | ✗✗✗✗ | ≡ | ≡ | – | ✗✗✗ | ≡ | ✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.6RS_{max}1.5$ | ≡ | ✓✓✓✓ | ≡ | ✓✓✓ | ≡ | ✓✓✓ | – | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.6RS_{max}2$ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S5N5M4RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ≡ | ✓✓✓ | ≡ | ✓✓✓ | ≡ | ≡ | – | ≡ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S5N5M4RS_{min}0.2RS_{max}2$ | ≡ | ✓✓✓✓ | ≡ | ✓✓✓ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | – | ✗✗✗✗ | ✗✗✗ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ |
| $S5N5M4RS_{min}0.6RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ≡ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ≡ |
| $S5N5M4RS_{min}0.6RS_{max}2$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ≡ | – | ✓✓✓ | ✓✓✓ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ | – | ≡ | ✗✗✗✗ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}2$ | ✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ | ≡ | – | ✗✗✗✗ | ✗✗✗ |
| $S5N5M5RS_{min}0.6RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ≡ | ✓✓✓✓ | ✓✓✓✓ | – | ≡ |
| $S5N5M5RS_{min}0.6RS_{max}2$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ≡ | ≡ | ≡ | ✓✓✓ | ≡ | – |

(b) *(1+1)–EA*

| | $S4N4M4RS_{min}0.2RS_{max}1.5$ | $S4N4M4RS_{min}0.2RS_{max}2$ | $S4N4M4RS_{min}0.6RS_{max}1.5$ | $S4N4M4RS_{min}0.6RS_{max}2$ | $S4N4M5RS_{min}0.2RS_{max}1.5$ | $S4N4M5RS_{min}0.2RS_{max}2$ | $S4N4M5RS_{min}0.6RS_{max}1.5$ | $S4N4M5RS_{min}0.6RS_{max}2$ | $S5N5M4RS_{min}0.2RS_{max}1.5$ | $S5N5M4RS_{min}0.2RS_{max}2$ | $S5N5M4RS_{min}0.6RS_{max}1.5$ | $S5N5M4RS_{min}0.6RS_{max}2$ | $S5N5M5RS_{min}0.2RS_{max}1.5$ | $S5N5M5RS_{min}0.2RS_{max}2$ | $S5N5M5RS_{min}0.6RS_{max}1.5$ | $S5N5M5RS_{min}0.6RS_{max}2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S4N4M4RS_{min}0.2RS_{max}1.5$ | – | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ✗✗✗✗ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M4RS_{min}0.2RS_{max}2$ | ≡ | – | ✗✗✗✗ | ✗✗✗ | ✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M4RS_{min}0.6RS_{max}1.5$ | ✓✓✓ | ✓✓✓✓ | – | ≡ | ≡ | ✓✓✓✓ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ≡ | ≡ | ≡ | ✗✗✗ | ✗✗✗ |
| $S4N4M4RS_{min}0.6RS_{max}2$ | ≡ | ✓✓✓ | ≡ | – | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓ | ≡ | ≡ | – | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.2RS_{max}2$ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ | ≡ | – | ✗✗✗✗ | ≡ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ |
| $S4N4M5RS_{min}0.6RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ≡ | ✓✓✓ | ✓✓✓✓ | – | ✓✓✓ | ≡ | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.6RS_{max}2$ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ✗✗✗ | – | ≡ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ |
| $S5N5M4RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ✓✓✓ | ≡ | ≡ | – | ≡ | ✗✗✗✗ | ✗✗✗ | ✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗ |
| $S5N5M4RS_{min}0.2RS_{max}2$ | ≡ | ✓✓✓✓ | ≡ | ≡ | ≡ | ✓✓✓✓ | ≡ | ≡ | ≡ | – | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ | ≡ | ≡ |
| $S5N5M4RS_{min}0.6RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ≡ | ✓✓✓ | ✓✓✓✓ | ≡ | ≡ |
| $S5N5M4RS_{min}0.6RS_{max}2$ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓ | ≡ | ≡ | – | ≡ | ✓✓✓ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓ | ≡ | ✗✗✗ | ≡ | – | ✓✓✓ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}2$ | ≡ | ✓✓✓✓ | ≡ | ≡ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ✗✗✗✗ | ✗✗✗ | ✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ |
| $S5N5M5RS_{min}0.6RS_{max}1.5$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ≡ | ≡ | ≡ | ✓✓✓✓ | – | ≡ |
| $S5N5M5RS_{min}0.6RS_{max}2$ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓ | ✓✓✓ | ≡ | ≡ | ≡ | ✓✓✓✓ | ≡ | – |

Table 2: Statistical comparison between each pair of CRAG configurations in terms of $|Tests|$. (Legend. ≡: no significant difference between the two approaches. ✓: the approach on the row is *better* than the one on column, ✗ means that it is worse; the number of symbols identifies the strength of the difference: *negligible* (✓, ✗), *small* (✓✓, ✗✗), *medium* (✓✓✓, ✗✗✗), *large* (✓✓✓✓, ✗✗✗✗))

(a) Random search

| | $S4N4M4RS_{min}0.2RS_{max}1.5$ | $S4N4M4RS_{min}0.2RS_{max}2$ | $S4N4M4RS_{min}0.6RS_{max}1.5$ | $S4N4M4RS_{min}0.6RS_{max}2$ | $S4N4M5RS_{min}0.2RS_{max}1.5$ | $S4N4M5RS_{min}0.2RS_{max}2$ | $S4N4M5RS_{min}0.6RS_{max}1.5$ | $S4N4M5RS_{min}0.6RS_{max}2$ | $S5N5M4RS_{min}0.2RS_{max}1.5$ | $S5N5M4RS_{min}0.2RS_{max}2$ | $S5N5M4RS_{min}0.6RS_{max}1.5$ | $S5N5M4RS_{min}0.6RS_{max}2$ | $S5N5M5RS_{min}0.2RS_{max}1.5$ | $S5N5M5RS_{min}0.2RS_{max}2$ | $S5N5M5RS_{min}0.6RS_{max}1.5$ | $S5N5M5RS_{min}0.6RS_{max}2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S4N4M4RS_{min}0.2RS_{max}1.5$ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S4N4M4RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | – | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ✓✓✓ | ≡ | ✓✓✓✓ |
| $S4N4M4RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ✗✗✗ | – | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S4N4M4RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ |
| $S4N4M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | – | ✓✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ✓✓✓ | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ✓✓✓ | ✓✓✓ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗✗ | – | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ |
| $S5N5M4RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S5N5M4RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | – | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S5N5M4RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | – | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S5N5M4RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S5N5M5RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | – | ≡ | ✓✓✓✓ |
| $S5N5M5RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | – | ✓✓✓✓ |
| $S5N5M5RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – |

(b) *(1+1)–EA*

| | $S4N4M4RS_{min}0.2RS_{max}1.5$ | $S4N4M4RS_{min}0.2RS_{max}2$ | $S4N4M4RS_{min}0.6RS_{max}1.5$ | $S4N4M4RS_{min}0.6RS_{max}2$ | $S4N4M5RS_{min}0.2RS_{max}1.5$ | $S4N4M5RS_{min}0.2RS_{max}2$ | $S4N4M5RS_{min}0.6RS_{max}1.5$ | $S4N4M5RS_{min}0.6RS_{max}2$ | $S5N5M4RS_{min}0.2RS_{max}1.5$ | $S5N5M4RS_{min}0.2RS_{max}2$ | $S5N5M4RS_{min}0.6RS_{max}1.5$ | $S5N5M4RS_{min}0.6RS_{max}2$ | $S5N5M5RS_{min}0.2RS_{max}1.5$ | $S5N5M5RS_{min}0.2RS_{max}2$ | $S5N5M5RS_{min}0.6RS_{max}1.5$ | $S5N5M5RS_{min}0.6RS_{max}2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S4N4M4RS_{min}0.2RS_{max}1.5$ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S4N4M4RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | – | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ |
| $S4N4M4RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ≡ | – | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S4N4M4RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | – | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ✓✓✓ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | – | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S4N4M5RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✓✓✓ |
| $S5N5M4RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S5N5M4RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | – | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S5N5M4RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | – | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ |
| $S5N5M4RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | ≡ | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ | – | ✓✓✓✓ | ✓✓✓✓ | ✓✓✓✓ |
| $S5N5M5RS_{min}0.2RS_{max}2$ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | – | ≡ | ✓✓✓✓ |
| $S5N5M5RS_{min}0.6RS_{max}1.5$ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ✗✗✗ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | ≡ | ✓✓✓✓ | ✗✗✗✗ | ≡ | – | ✓✓✓✓ |
| $S5N5M5RS_{min}0.6RS_{max}2$ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | ≡ | ✗✗✗✗ | ✗✗✗✗ | ✗✗✗✗ | – |

Table 3: Statistical comparison between each pair of CRAG configurations in terms of *div*. (Legend. ≡: no significant difference between the two approaches. ✓: the approach on the row is *better* than the one on column, ✗ means that it is worse; the number of symbols identifies the strength of the difference: *negligible* (✓, ✗), *small* (✓✓, ✗✗), *medium* (✓✓✓, ✗✗✗), *large* (✓✓✓✓, ✗✗✗✗))

(a) Random search

| | $S4N4M4RS_{min}0.2RS_{max}1.5$ | $S4N4M4RS_{min}0.2RS_{max}2$ | $S4N4M4RS_{min}0.6RS_{max}1.5$ | $S4N4M4RS_{min}0.6RS_{max}2$ | $S4N4M5RS_{min}0.2RS_{max}1.5$ | $S4N4M5RS_{min}0.2RS_{max}2$ | $S4N4M5RS_{min}0.6RS_{max}1.5$ | $S4N4M5RS_{min}0.6RS_{max}2$ | $S5N5M4RS_{min}0.2RS_{max}1.5$ | $S5N5M4RS_{min}0.2RS_{max}2$ | $S5N5M4RS_{min}0.6RS_{max}1.5$ | $S5N5M4RS_{min}0.6RS_{max}2$ | $S5N5M5RS_{min}0.2RS_{max}1.5$ | $S5N5M5RS_{min}0.2RS_{max}2$ | $S5N5M5RS_{min}0.6RS_{max}1.5$ | $S5N5M5RS_{min}0.6RS_{max}2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S4N4M4RS_{min}0.2RS_{max}1.5$ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M4RS_{min}0.2RS_{max}2$ | ≡ | – | ≡ | ≡ | ✗✗✗ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M4RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M4RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.2RS_{max}1.5$ | ≡ | ✓✓✓ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ✓✓✓ | ✓✓✓ | ✓✓✓ | |
| $S4N4M5RS_{min}0.2RS_{max}2$ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ✓✓✓ | ≡ | ≡ | ✓✓✓ | ✓✓✓ | ✓✓✓ |
| $S4N4M5RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.6RS_{max}2$ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ✓✓✓ | ✓✓✓ | ✓✓✓ | |
| $S5N5M4RS_{min}0.2RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S5N5M4RS_{min}0.2RS_{max}2$ | ≡ | ✓✓✓ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ✓✓✓ | ✓✓✓ | ✓✓✓ | |
| $S5N5M4RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S5N5M4RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ✗✗✗ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | – | ≡ | ≡ |
| $S5N5M5RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ✗✗✗ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ≡ | – | ≡ |
| $S5N5M5RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ✗✗✗ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ✗✗✗ | ≡ | ≡ | ≡ | ≡ | ≡ | – |

(b) *(1+1)–EA*

| | $S4N4M4RS_{min}0.2RS_{max}1.5$ | $S4N4M4RS_{min}0.2RS_{max}2$ | $S4N4M4RS_{min}0.6RS_{max}1.5$ | $S4N4M4RS_{min}0.6RS_{max}2$ | $S4N4M5RS_{min}0.2RS_{max}1.5$ | $S4N4M5RS_{min}0.2RS_{max}2$ | $S4N4M5RS_{min}0.6RS_{max}1.5$ | $S4N4M5RS_{min}0.6RS_{max}2$ | $S5N5M4RS_{min}0.2RS_{max}1.5$ | $S5N5M4RS_{min}0.2RS_{max}2$ | $S5N5M4RS_{min}0.6RS_{max}1.5$ | $S5N5M4RS_{min}0.6RS_{max}2$ | $S5N5M5RS_{min}0.2RS_{max}1.5$ | $S5N5M5RS_{min}0.2RS_{max}2$ | $S5N5M5RS_{min}0.6RS_{max}1.5$ | $S5N5M5RS_{min}0.6RS_{max}2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $S4N4M4RS_{min}0.2RS_{max}1.5$ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M4RS_{min}0.2RS_{max}2$ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M4RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M4RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.2RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.2RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S4N4M5RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S5N5M4RS_{min}0.2RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S5N5M4RS_{min}0.2RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S5N5M4RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ | ≡ |
| $S5N5M4RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ | ≡ |
| $S5N5M5RS_{min}0.2RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ | ≡ |
| $S5N5M5RS_{min}0.6RS_{max}1.5$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – | ≡ |
| $S5N5M5RS_{min}0.6RS_{max}2$ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | ≡ | – |

Table 4: Statistical comparison between *(1+1)–EA* and random search used in `CRAG`. (Legend. ≡: no significant difference between the two search algorithms. ✓: *(1+1)–EA* is *better* than random search, ✗ means that it is worse; the number of symbols identifies the strength of the difference: *negligible* (✓, ✗), *small* (✓✓, ✗✗), *medium* (✓✓✓, ✗✗✗), *large* (✓✓✓✓, ✗✗✗✗))

(a) *#fail*

| | |
|---|---|
| ≡ | $S4N4M4RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S4N4M4RS_{min}0.2RS_{max}2$ |
| ≡ | $S4N4M4RS_{min}0.6RS_{max}1.5$ |
| ✓✓✓ | $S4N4M4RS_{min}0.6RS_{max}2$ |
| ≡ | $S4N4M5RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S4N4M5RS_{min}0.2RS_{max}2$ |
| ✓✓✓ | $S4N4M5RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S4N4M5RS_{min}0.6RS_{max}2$ |
| ≡ | $S5N5M4RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S5N5M4RS_{min}0.2RS_{max}2$ |
| ≡ | $S5N5M4RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S5N5M4RS_{min}0.6RS_{max}2$ |
| ≡ | $S5N5M5RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S5N5M5RS_{min}0.2RS_{max}2$ |
| ≡ | $S5N5M5RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S5N5M5RS_{min}0.6RS_{max}2$ |

(b) $|Tests|$

| | |
|---|---|
| ≡ | $S4N4M4RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S4N4M4RS_{min}0.2RS_{max}2$ |
| ≡ | $S4N4M4RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S4N4M4RS_{min}0.6RS_{max}2$ |
| ≡ | $S4N4M5RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S4N4M5RS_{min}0.2RS_{max}2$ |
| ≡ | $S4N4M5RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S4N4M5RS_{min}0.6RS_{max}2$ |
| ≡ | $S5N5M4RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S5N5M4RS_{min}0.2RS_{max}2$ |
| ≡ | $S5N5M4RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S5N5M4RS_{min}0.6RS_{max}2$ |
| ≡ | $S5N5M5RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S5N5M5RS_{min}0.2RS_{max}2$ |
| ≡ | $S5N5M5RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S5N5M5RS_{min}0.6RS_{max}2$ |

(c) *div*

| | |
|---|---|
| ≡ | $S4N4M4RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S4N4M4RS_{min}0.2RS_{max}2$ |
| ≡ | $S4N4M4RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S4N4M4RS_{min}0.6RS_{max}2$ |
| ≡ | $S4N4M5RS_{min}0.2RS_{max}1.5$ |
| ✗✗✗ | $S4N4M5RS_{min}0.2RS_{max}2$ |
| ≡ | $S4N4M5RS_{min}0.6RS_{max}1.5$ |
| ✗✗✗ | $S4N4M5RS_{min}0.6RS_{max}2$ |
| ≡ | $S5N5M4RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S5N5M4RS_{min}0.2RS_{max}2$ |
| ≡ | $S5N5M4RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S5N5M4RS_{min}0.6RS_{max}2$ |
| ≡ | $S5N5M5RS_{min}0.2RS_{max}1.5$ |
| ≡ | $S5N5M5RS_{min}0.2RS_{max}2$ |
| ≡ | $S5N5M5RS_{min}0.6RS_{max}1.5$ |
| ≡ | $S5N5M5RS_{min}0.6RS_{max}2$ |