5.14   alldifferent_consecutive_values

Origin   Derived from alldifferent.

Constraint   alldifferent_consecutive_values(VARIABLES)

Argument   VARIABLES : collection(var−dvar)

Restrictions   required(VARIABLES, var)
                     alldifferent(VARIABLES)

Purpose   Enforce (1) all variables of the collection VARIABLES to take distinct values and (2) constraint the difference between the largest and the smallest values of the VARIABLES collection to be equal to the number of variables minus one (i.e., there is no holes at all within the used values).

Example $(\langle 5, 4, 3, 6 \rangle)$

The alldifferent_consecutive_values constraint holds since (1) all the values 5, 4, 3 and 6 are distinct and since (2) all values between value 3 and value 6 are actually used.

All solutions   Figure   5.33   gives   all   solutions   to   the   following   non   ground   instance   of   the   alldifferent_consecutive_values   constraint: $V_1 \in \{0, 1, 3, 4, 5, 6, 7, 8\}$, $V_2 \in [4, 5]$, $V_3 \in [3, 4]$, $V_4 \in [0, 7]$, $V_5 \in [3, 4]$, alldifferent_consecutive_values($\langle V_1, V_2, V_3, V_4, V_5 \rangle$).

① $(\langle \mathbf{1}, \mathbf{5}, 3, 2, 4 \rangle)$
② $(\langle \mathbf{1}, \mathbf{5}, 4, 2, 3 \rangle)$
③ $(\langle \mathbf{6}, 5, 3, \mathbf{2}, 4 \rangle)$
④ $(\langle 6, 5, \mathbf{3}, \mathbf{7}, 4 \rangle)$
⑤ $(\langle \mathbf{6}, 5, 4, \mathbf{2}, 3 \rangle)$
⑥ $(\langle 6, 5, 4, \mathbf{7}, \mathbf{3} \rangle)$
⑦ $(\langle \mathbf{7}, 5, \mathbf{3}, 6, 4 \rangle)$
⑧ $(\langle \mathbf{7}, 5, 4, 6, \mathbf{3} \rangle)$

Figure 5.33: All solutions corresponding to the non ground example of the alldifferent_consecutive_values constraint of the **All solutions** slot, where the smallest and largest values are respectively coloured in orange and red

Typical $|\text{VARIABLES}| > 2$

Symmetries   • Items of VARIABLES are permutable.

                     • Two distinct values of VARIABLES.var can be swapped.

                     • One and the same constant can be added to the var attribute of all items of VARIABLES.

Counting

Length (n)	2	3	4	5	6	7	8	9	10
Solutions	4	12	48	240	1440	10080	80640	725760	7257600

Number of solutions for `alldifferent_consecutive_values`: domains $0..n$

Solution density for `alldifferent_consecutive_values`

Solution density for `alldifferent_consecutive_values`
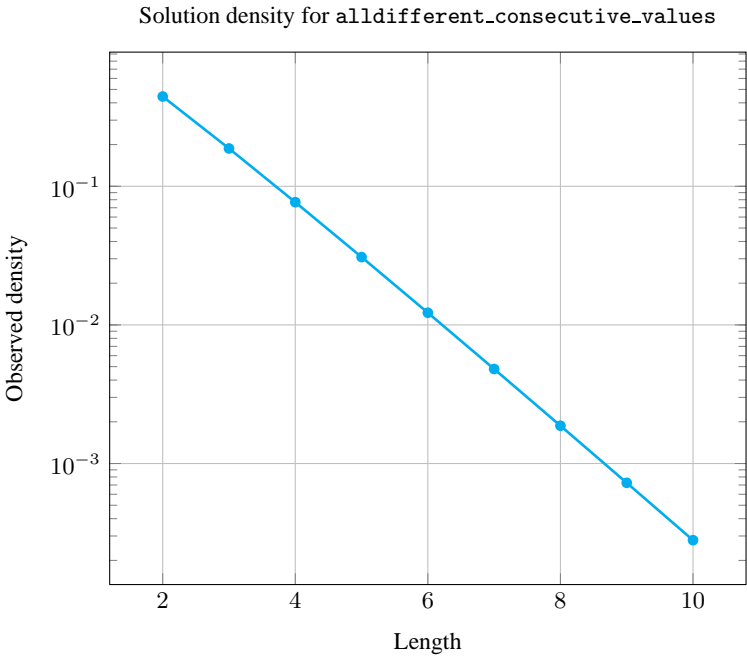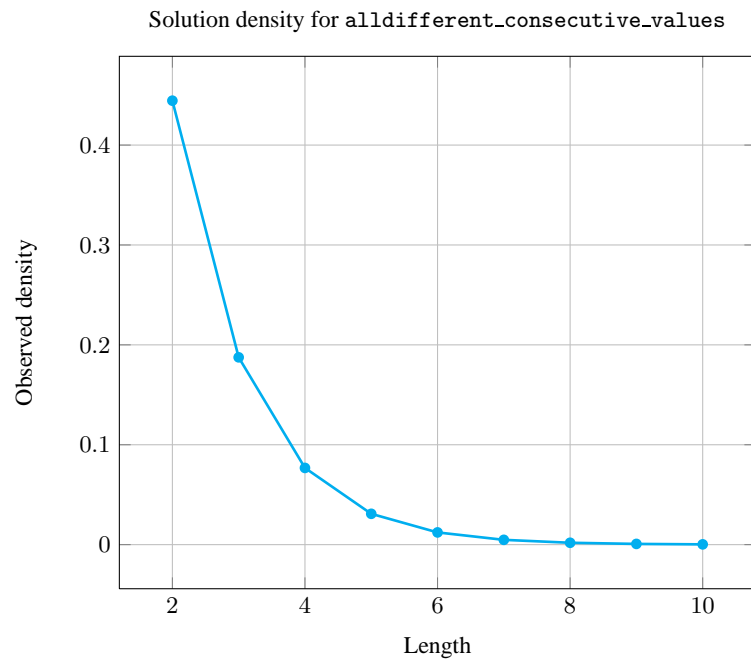
See also　**implied by:** `permutation`.

implies: `alldifferent`, `consecutive_values`.

Keywords　**characteristic of a constraint:** all different, disequality, sort based reformulation.

combinatorial object: permutation.

constraint type: value constraint.

Cond. implications　• `alldifferent_consecutive_values(VARIABLES)`
with `minval(VARIABLES.var)` ≤ 0
and `maxval(VARIABLES.var)` ≥ 0
implies `among_diff_0(NVAR, VARIABLES)`
when `NVAR` $= |$`VARIABLES`$| - 1$.

• `alldifferent_consecutive_values(VARIABLES)`
with `minval(VARIABLES.var)` > 0
implies `among_diff_0(NVAR, VARIABLES)`
when `NVAR` $= |$`VARIABLES`$|$.

• `alldifferent_consecutive_values(VARIABLES)`
with `maxval(VARIABLES.var)` < 0
implies `among_diff_0(NVAR, VARIABLES)`
when `NVAR` $= |$`VARIABLES`$|$.

• `alldifferent_consecutive_values(VARIABLES)`
implies `balance(BALANCE, VARIABLES)`
when `BALANCE` $= 0$.

- alldifferent_consecutive_values(VARIABLES)
  with $|\text{VARIABLES}| > 0$
  implies length_first_sequence(LEN, VARIABLES)
  when $\text{LEN} = 1$.

- alldifferent_consecutive_values(VARIABLES)
  with $|\text{VARIABLES}| > 0$
  implies length_last_sequence(LEN, VARIABLES)
  when $\text{LEN} = 1$.

- alldifferent_consecutive_values(VARIABLES)
  implies max_n(MAX, RANK, VARIABLES)
  when $\text{MAX} = \text{maxval}(\text{VARIABLES.var}) - \text{RANK}$.

- alldifferent_consecutive_values(VARIABLES)
  implies min_n(MIN, RANK, VARIABLES)
  when $\text{MIN} = \text{minval}(\text{VARIABLES.var}) + \text{RANK}$.

- alldifferent_consecutive_values(VARIABLES)
  with $|\text{VARIABLES}| > 0$
  implies min_nvalue(MIN, VARIABLES)
  when $\text{MIN} = 1$.

- alldifferent_consecutive_values(VARIABLES)
  with $\text{minval}(\text{VARIABLES.var}) = 0$
  implies ninterval(NVAL, VARIABLES, SIZE_INTERVAL)
  when $\text{NVAL} = (|\text{VARIABLES}| + \text{SIZE\_INTERVAL} - 1)/\text{SIZE\_INTERVAL}$.

- alldifferent_consecutive_values(VARIABLES)
  implies range_ctr(VARIABLES, CTR, VARIABLES)
  when $\text{CTR} \in [\leq]$
  and $\text{R} = |\text{VARIABLES}|$.

- alldifferent_consecutive_values(VARIABLES)
  implies soft_alldifferent_ctr(C, VARIABLES).

Arc input(s)	VARIABLES
Arc generator	$SELF \mapsto \texttt{collection}(\texttt{variables})$
Arc arity	1
Arc constraint(s)	TRUE
Graph property(ies)	$\textbf{RANGE}(\texttt{VARIABLES}, \texttt{var}) = |\texttt{VARIABLES}| - 1$