

`torch.Tensor.size`

$$\frac{\sigma \vdash E \Rightarrow e, c}{\sigma \vdash E.\text{size}() \Rightarrow \text{shapeToTuple}(e), c}$$

$$\frac{\begin{array}{l} \sigma \vdash E \Rightarrow e, c \\ k = \mathbf{rank}(e) \\ c' = \{(k \geq 1) \wedge (0 \leq n < k)\} \end{array}}{\sigma \vdash E.\text{size}(n) \Rightarrow e[n+1], c \cup c'}$$

`torch.tensor`

$$\frac{\sigma \vdash E \Rightarrow e, c}{\sigma \vdash \mathbf{tensor}(E) \Rightarrow e, c}$$

`torch.Tensor.shape`

$$\frac{\sigma \vdash E \Rightarrow e, c}{\sigma \vdash E.\mathbf{shape} \Rightarrow \text{shapeToTuple}(e), c}$$

`torch.range`

$$\frac{\begin{array}{l} d \neq 0 \\ (e - s)/d > 0 \end{array}}{\sigma \vdash \mathbf{range}(s, e, d) \Rightarrow (1 + \lfloor (e - s)/d \rfloor), \emptyset}$$

Default: $s = 0, d = 1$

`torch.Tensor.item`

$$\frac{\begin{array}{l} \sigma \vdash E \Rightarrow e, c \\ k = \mathbf{rank}(e) \\ c' = \{(k = 1) \wedge (e[1] = 1)\} \end{array}}{\sigma \vdash E.\mathbf{item}() \Rightarrow (), c \cup c'}$$

`torch.split`

$$\frac{\begin{array}{l} \sigma \vdash E \Rightarrow e, c \\ k = \mathbf{rank}(e) \\ e_1 = (n)@e[2:k] \\ e_2 = (n)@e[2:k] \\ \dots \\ e_{l-1} = (n)@e[2:k] \\ e_l = (n')@e[2:k] \quad \text{where } e[1] = n(l-1) + n', 0 < n' \leq n \\ c' = \{(k \geq 1)\} \end{array}}{\sigma \vdash \mathbf{split}(E, n) \Rightarrow (e_1, e_2, \dots, e_l), c \cup c'}$$

l -원소 tuple 형태로 반환

$$\begin{array}{l}
\sigma \vdash E \Rightarrow e, c \\
k = \mathbf{rank}(e) \\
e_1 = (n_1)@e[2:k] \\
e_2 = (n_2)@e[2:k] \\
\vdots \\
e_l = (n_l)@e[2:k] \\
c' = \{(k \geq 1) \wedge (e[1] = n_1 + n_2 + \dots + n_l)\} \\
\hline
\sigma \vdash \mathbf{split}(E, [n_1, n_2, \dots, n_l]) \Rightarrow (e_1, e_2, \dots, e_l), c \cup c'
\end{array}$$

l -원소 tuple 형태로 반환

$$\begin{array}{l}
\sigma \vdash E \Rightarrow e, c \\
k = \mathbf{rank}(e) \\
e_1 = e[1:x]@(n)@e[x+2:k] \\
e_2 = e[1:x]@(n)@e[x+2:k] \\
\vdots \\
e_{l-1} = e[1:x]@(n)@e[x+2:k] \\
e_l = e[1:x]@(n')@e[x+2:k] \quad \text{where } e[1] = n(l-1) + n', 0 < n' \leq n \\
c' = \{(k \geq 1) \wedge (0 \leq x < k)\} \\
\hline
\sigma \vdash \mathbf{split}(E, n, x) \Rightarrow (e_1, e_2, \dots, e_l), c \cup c'
\end{array}$$

l -원소 tuple 형태로 반환

$$\begin{array}{l}
\sigma \vdash E \Rightarrow e, c \\
k = \mathbf{rank}(e) \\
e_1 = e[1:x]@(n_1)@e[x+2:k] \\
e_2 = e[1:x]@(n_2)@e[x+2:k] \\
\vdots \\
e_l = e[1:x]@(n_l)@e[x+2:k] \\
c' = \{(k \geq 1) \wedge (0 \leq x < k) \wedge (e[x+1] = n_1 + n_2 + \dots + n_l)\} \\
\hline
\sigma \vdash \mathbf{split}(E, [n_1, n_2, \dots, n_l], x) \Rightarrow (e_1, e_2, \dots, e_l), c \cup c'
\end{array}$$

l -원소 tuple 형태로 반환

`torch.zeros`, `torch.rand`, `torch.randn`

$$\forall \mathbf{ft} \in \{\mathbf{zeros}, \mathbf{rand}, \mathbf{randn}\}, \quad \frac{}{\sigma \vdash \mathbf{ft}(t_1, t_2, \dots, t_l) \Rightarrow (t_1, t_2, \dots, t_l), \emptyset}$$

`torch.max`

$$\frac{\sigma \vdash E \Rightarrow \neg, c}{\sigma \vdash \mathbf{max}(E) \Rightarrow (), c}$$

$$\begin{array}{l}
\sigma \vdash E \Rightarrow e, c \\
k = \mathbf{rank}(e) \\
e' = e[1:n]@e[n+2:k] \\
c' = \{(k \geq 1) \wedge (0 \leq n < k)\} \\
\hline
\sigma \vdash \mathbf{max}(E, n) \Rightarrow (e', e'), c \cup c'
\end{array}$$

tuple 형태로 반환

$$\begin{array}{c}
\sigma \vdash E \Rightarrow e, c \\
k = \mathbf{rank}(e) \\
e' = e[1:n]@ (1) @ e[n+2:k] \\
c' = \{(k \geq 1) \wedge (0 \leq n < k)\} \\
\hline
\sigma \vdash \mathbf{max}(E, n, True) \Rightarrow (e', e'), c \cup c'
\end{array}$$

tuple 형태로 반환

$$\begin{array}{c}
\sigma \vdash \mathbf{max}(E, n) \Rightarrow (e, e), c \\
\hline
\sigma \vdash \mathbf{max}(E, n, False) \Rightarrow (e, e), c
\end{array}$$

tuple 형태로 반환

$$\begin{array}{c}
\sigma \vdash E_1 \Rightarrow e_1, c_1 \\
\sigma \vdash E_2 \Rightarrow e_2, c_2 \\
\hline
\sigma \vdash \mathbf{max}(E_1, E_2) \Rightarrow broadcast(e_1, e_2), c_1 \cup c_2 \cup broadcastable(e_1, e_2)
\end{array}$$