The partial transpose of density matrices in many-body systems has been known as a good candidate to diagnose quantum entanglement of mixed states. In particular, it can be used to define the (logarithmic) entanglement negativity for bosonic systems. In this talk, I introduce partial time-reversal transformation as an analog of partial transpose for fermions. This definition naturally arises from the spacetime picture of partially transposed density matrices in which partial transpose is equivalent to reversing the arrow of time for one subsystem relative to the other subsystem. I will show the success of this definition in capturing the entanglement within fermionic symmetry-protected topological phases as well as conformal field theories. Further, I will explain how to simulate partition functions on non-orientable spacetime manifolds by using the partial time-reversal transformation.