In this work, we will revisit the phenomenon of the glass transition in a classical spin glass system (a system where the interactions are randomly frustrated) by means of numerical Monte Carlo simulations. More specifically, we will use the Metropolis algorithm with a single spin flip procedure to sample the phase space of the system and therefore calculate its main thermodynamical properties (internal energy, magnetization, specific heat, susceptibility and Anderson’s order parameter) for the further analysis of the glassy phase transition. As a spin glass has a huge and complex phase space, the analysis of any phase transition temperature (in our case, to obtain the glass transition temperature $T_g$) is very difficult to obtain by means of any single spin flip algorithm. For this reason, we will also use a numerical optimization method, namely the Simulated Annealing method to obtain a more accurate estimate of $T_g$. All this will be done for a square lattice of classical magnetic spins (Ising like) where ferromagnetic interactions compete with a given concentration $p$ of antiferromagnetic interactions. We will determine $T_g$ for different values of $p$, ranging from $p = 0.0$ (pure Ising model) to $p = 0.5$ (known as the Edwards-Anderson spin glass). This will be done to check whether the system is in a glassy state or not. In addition, we will present a projection of the possible transition temperatures for an infinite system as a function of the concentrations of antiferromagnetic interactions.