We present the results of an observation of the starburst galaxy IC 342. Thirty-seven X-ray point sources were detected down to a luminosity limit of $\sim 10^{37}$. Most of the sources are located near the spiral arms. The X-ray point source luminosity function is consistent with a power-law shape with a slope of 0.55, typical of starburst galaxies. We also present the energy spectra of several ultraluminous X-ray sources (ULXs), including the luminous X-ray source in the galactic nucleus. Except for the nucleus and a luminous supersoft X-ray source, other ULXs can generally be fit with a simple power-law spectral model. The nucleus is very luminous ($\sim 10^{40}$ in 0.2–12 keV) and requires disc blackbody and power-law components to describe the X-ray emission. The spectral fit reveals a cool accretion disc ($kT = 0.11$ keV) and suggests that the source harbours either an intermediate-mass black hole or a stellar-mass black hole with outflow.