(2) What is the probability that a straight line drawn from the Earth in an arbitrary direction (excluding towards the sun) will hit a star in this Galaxy? Assume 10^{11} solar type stars and 10 kpc to Galactic center.

A star like the sun subtends a solid angle $\Delta\Omega = \pi R_0^2/r^2$ at a distance r from us. The average solid angle is therefore $\pi R_0^2 \langle 1/r^2 \rangle$, where the average value of r^{-2} depends upon the distribution of stars. Particularly since stars are concentrated towards the nucleus of the galaxy, it is not unreasonable to use the distance $D = 10$ kpc of the sun from the center of the galaxy, i.e., $\langle 1/r^2 \rangle = 1/D^2$. The total subtended solid angle is therefore $N\pi R_0^2/D^2$ which is about 2×10^{-13} of the entire 4π steradians.