Photometry

Aperture photometry means drawing electronic apertures around sources of interest, subtracting off from each pixel any background emission (sky, extragalactic diffuse light, zodiacal light, etc) estimated by the mean level of a background region of the image, and then adding up the remaining light in the aperture. Apertures may be any shape and size.

Mathematically, the total signal is:

$S = T - AB$ → average value of the background
→ number of pixels in the aperture
→ total flux in the aperture

How to choose apertures ?

For stars, it's safe to choose an aperture larger than the FWHM of the PSF (except for very crowded fields or faint stars). The larger the aperture, the more signal you get, but also the more noise you add. See Ch. 5 of Howell for the trade-offs of S/N and collecting stellar light.

Typically, you want to choose an aperture that maximizes S/N.

For the background, choose an inner and outer radius that avoid source counts, yield at least 100 pixels in the annulus (but preferably a few hundred), and avoid nearby stars.

A few other notes and misconceptions:

- You do not need to adjust the aperture size for stars of different brightness because the PSF for a bright and faint star is the same (if the seeing is unchanged across

the frame). A 5 arcsec radius aperture will capture the same fraction of light from the faint star and the bright star, even though in the grayscale image it appears as if the bright star is "bigger". This is a deceptive feature of grayscale displays.

2. If your aperture misses 10% of the light from a star (0.1 mag!) then the same size aperture will also miss 10% of the light from your standard stars. This will all be accounted for when you compute the zero point offsets to bring your instrumental magnitude system onto the standard system.