I. Normal Galaxies

I.1 Definition - gravitationally bound group of stars (+ gas & dust). The main source of luminosity is from a population of stars older than a few billion years (e.g. main sequence stars like the Sun, and red giants of a few solar masses).

I.2 Formation
   
   Epoch - most galaxies appear to have formed during the first 10-20% of the age of the Universe (or something like 10^-12 billion years ago)
   
   Masses -- the range appears to be from $10^5 M_{\odot}$ to $10^{12} M_{\odot}$ of stars
   
   Method -- Either monolithic gravitational collapse of giant rotating cloud of gas, or gravitational collapse of smaller fragments first, followed by collision and merger of fragments to build up larger object.

I.3 Current Morphological Types
   
   E (elliptical) mostly old (PopII) stars; no disk; little or no gas and dust
   
   S,SB (spiral, barred spiral) old (PopII) stars in bulge/halo; young (PopI) stars+gas&dust in disk
   
   Irr (irregular) irregular shape, mostly lower mass galaxy with mixture of old and young stars

II. Active Galaxies

II.1 Definition - generally the same properties as normal galaxies (e.g. overall size, mass), but in addition, either a substantial superimposed population of very young massive stars (starburst galaxies), and/or substantial luminosity from a massive nuclear black hole (active galactic nucleus or AGN)

II.2 Formation
   
   Epoch -- At all times, but active galaxies were most numerous at 30-60% the age of the Universe
   
   Masses -- generally the same range as normal galaxies, but slightly favoring higher mass galaxies
   
   Method -- Interactions and mergers of gas rich spirals (or spiral and elliptical). A galaxy-wide starburst typically forms first in the spirals, followed by a strong starburst in the merger nucleus plus substantial additional luminosity from the building and feeding of a massive black hole.
   
   Transformation -- Merging spirals may be the dominant mechanism for forming most regular and giant sized Es. Dwarf Es and small Irrs are also “thrown out” from the merger remnant.

II.3 Types
   
   Starbursts, Nuclear starbursts - interacting/merging spirals with galaxy-wide or nuclear-concentrated population of young massive stars accounting for more than 20% of total luminosity.
   
   Seyfert galaxies - substantial luminosity from accretion of gas onto a massive black hole
   
   Radio galaxies - Seyfert galaxies with prominent “jets” of radio emission
   
   Quasars - The most powerful Seyfert galaxies, with 100-1000 times the total luminosity of the Milky Way emanating from a region of less than 100pc size around a very Massive Black Hole