Quiz 4- ASTRO-1 Spring 2017 YOUR NAME:_____

1. Dark Matter has been invoked to explain observations on very different spatial scales. Which of the following indicate the need for Dark Matter?

____ inhomogeneities in the cosmic microwave background at the 10^{-5} level

__X__ the "flat" rotation curves of the Milky Way Galaxy and other galaxies

__X__ the formation of large scale structure in the Universe

____ the acceleration of the expansion of the Universe

2. Based on our current data and models, what is the most likely long-term fate of the Universe? (select one)

___ Increasing expansion rate and increase of the temperature of the background radiation

___ Eventual slowing of the expansion to stop as time reaches infinity

___ All matter converted to iron, the most stable atom, and continuous cooling

_X__ Increased expansion rate, decreased star formation to zero, cooler and darker

3. Which of the following best describes the large-scale distribution of matter in the Universe? (select one)

____ Dark matter is uniform in all directions, visible matter is highly clumped

__X__ Dark and visible matter is highly non-uniform in distribution

____ Matter is uniformly distributed except for small density variations at the level of 10^{-5}

____ Quantum fluctuations before inflation produced galaxies that are moving away at a speed that is proportional to their distance

4. The theory of cosmic inflation was originally motivated to understand why magnetic monopoles were so rare in the Universe. What other cosmological puzzles does inflation resolve? (select any that apply)

___ The "horizon" problem that prevents us from seeing past the nearest super cluster of galaxies

___ The "Dark Energy" problem that creates acceleration of the expansion

_X__ the origin of fluctuations that became the seeds of galaxy and structure formation is quantum fluctuations the grew via inflation

___ Inflation allows us to understand what existed before the Big Bang

5. Which of the following are true (T) and which false (F) regarding the cosmic microwave background?

_T___ It is radiation that originated about 380,000 years after the Big Bang

_T___ It is seen as microwave radiation in every direction on the sky

_F___ It is the relic radiation from the first stars that formed after the Big Bang, redshifted by a factor of ~1100

_T___ It has the spectrum of a ~3000K ionized plasma redshifted to appear like a 2.75K plasma

6. Which of the following are true (T), which false (F)?

_F___ the total star formation rate in the Universe has been relatively steady since about 1 billion years after the Big Bang

_F___ Quasars were much more common immediately after the Hot Big Bang and only exist at very large redshifts

_T___ the merger rate of galaxies has been steadily decreasing over time as the Universe expands

_T___ Dark Matter is much more common than the type of matter that makes up stars, planets and humans

7. Which of the following are fundamental particles? (check any that are)

___ Proton __X_ Electron ___ Hydrogen atom _X__ Up quark

8. Which of the following provide supporting evidence for the Hot Big Bang model? (select any that apply)

__X__ The abundances of elements heavier than He are lower than the solar values in older stars

__X__ The predicted abundances for He^4, He^3, H^2, and Li^7 at the time of "element freezeout" around 300 seconds after the Big Bang match observations

_X___ The presence of a ubiquitous background radiation characteristic of that from a 3K solid

__X__ fluctuations of around 1 part in 100,000 in the temperature of the cosmic microwave background

9. Which of the following techniques are used to detect planets orbiting stars other than the Sun? (select any that apply)

__X__ measuring small periodic radial velocity variations in the exoplanet host stars

__X__ measuring a small reduction in brightness when a planet passes in front of a parent star

____ parallax measurements of the nearest planets outside the solar system

____ using the largest radio telescopes to beam radar signals to all the stars in the solar neighborhood to identify objects too faint to be seen with optical telescopes

10. Which of the following are true (T) which false (F) regarding what we know about exoplanets as of June 2017?

__F__ Although we have now discovered many exoplanets, to date we have not found another system with more than one planet

_F___ The most common type of exoplanet discovered to date is approximately ½ the mass of the Earth

_F___ Most exoplanets discovered to date are very close to or in the "habitable zone" of their host stars

__T__ the majority of exoplanets discovered to date have been detected via the light curve/transit technique