Imagine that the research team of Garcia, Smith and Chen wanted to know whether the squirrels on the UCLA campus are more active on warm days than on cold days (A). At first, they had no information on this question. So, they measured the noontime temperature on campus on 48 days, spread over the 12 months of the year (B), and on each of those days, they observed squirrels in three representative locations on campus (C). Every 30 seconds (D), they recorded whether each observable squirrel was moving or stationary. It turned out that when noontime temperatures were between 65-85° F, squirrels spent more time moving than on days when noontime temperature was either below 65° or above 85°. “We think that when it’s unusually cold, the squirrels move less to conserve energy, and when it’s unusually hot, they move less to avoid overheating,” (E) wrote Garcia et al. in their research report.

(1) Statement (A) is a(n)
(a) Assumption
(b) Inference
(c) Hypothesis
(d) Data summary

(2) Statements (B), (C) and (D) pertain to
(a) Theoretical models
(b) Sampling techniques
(c) Statistical data analysis
(d) Research conclusions

(3) In this study, squirrel activity level and temperature are
(a) Dependent and independent variables, respectively
(b) Independent and dependent variables, respectively
(c) The variable and the constant, respectively, in the researchers’ theoretical model
(d) Unrelated to each other

(4) Statement (E) is a(n)/the
(a) Conclusion proven by the researchers’ results
(b) Hypothesis that motivated the researchers’ study
(c) Unwarranted guess that other researchers would be correct to dismiss
(d) Inference from the researchers’ results, and a hypothesis that could be tested in further research
(5) Which of the following is NOT one of the conditions necessary for natural selection to occur?

(a) Offspring tend to resemble their parents
(b) Variation – individuals differ from each other
(c) More offspring are produced than survive
(d) **Traits acquired by parents are transmitted to their offspring**

(6) To say that an individual *Pisum sativum* plant is homozygous for the allele for green seed color is to describe its

(a) Phenotype
(b) **Genotype**
(c) Mutation rate
(d) Selection pressure

(7) Reciprocal altruism

(a) Only occurs among kin
(b) Only occurs when C > B
(c) **Can occur if altruists are more likely than nonaltruists to receive altruism**
(d) None of the above

(8) Consistent with Trivers' view of sexual selection, females are larger than males, and compete for access to males

(a) in no known species of animal
(b) in species in which females invest more in each offspring than males
(c) **in species in which males invest more in each offspring than females**
(d) in species in which the only parental investment by either sex is the production of gametes

(9) Which of the following is predicted by Hamilton’s Rule?

(a) No altruism should evolve when $r < 0.5$
(b) Altruism evolves only when $r > 1.0$
(c) **More costly altruism can evolve as $r$ increases**
(d) (a) and (c) only
(10) According to the theory of parent-offspring conflict, an offspring, $A$, should prefer that its parent invest in itself, rather than its full-sibling $B$, unless $B$ would gain at least ______ benefit from the investment as $A$ would.

(a) Half as much
(b) **Twice as much**
(c) 1.5 times as much
(d) The same amount of

(11) The Trivers-Willard hypothesis is that parents will produce more sons than daughters

(a) In species with polyandrous mating systems
(b) 50% of the time
(c) **When their offspring are likely to be larger and healthier than average, in species with polygynous mating systems**
(d) When their offspring are likely to be smaller and sicklier than average, in species with polygynous mating systems

(12) If, in a particular species, females prefer to mate with more elaborately ornamented males, and the only benefit they obtain from this preference is that their sons inherit the ornament and are therefore more attractive to females in the next generation, the ornament can be explained by

(a) Zahavi’s handicap principle
(b) The Prisoner’s Dilemma model
(c) **Fisher’s “runaway” process**
(d) Hamilton’s kin selection model

(13) "People don't marry their siblings because close proximity during childhood produces sexual aversion between people." This is an example of a(n) ______ explanation of a behavior pattern.

(a) evolutionary
(b) **developmental**
(c) functional
(d) phylogenetic

(14) The Hawk/Dove Game teaches the lesson that

(a) **The effectiveness of a strategy can depend on its frequency**
(b) Natural selection favors more aggressive individuals
(c) For any mix of two strategies, an ESS will evolve in which the two strategies persist at roughly equal frequencies
(d) Group selection can reduce the level of aggression in animal societies
For Questions 15-18: Consider a bird species in which parents feed their nestlings. Natural selection favors allocating food among the nestlings to maximize the chance that all will survive. This means that hungrier nestlings should be fed more than their less hungry siblings. How can parents tell how hungry each nestling is?

(15) Suppose that smaller nestlings are usually hungrier than larger ones. Parents could use body size as a(n) _____ of hunger level.

(a) Signal  
(b) Cue  
(c) Index  
(d) Attenuator

(16) Suppose that extremely hungry nestlings shriek, while less hungry nestlings remain quiet. Furthermore, suppose that this shrieking, and parents’ response to it, are products of natural selection for indicating and assessing hunger levels. Occasionally, nestlings shriek even though they’re not extremely hungry. The shrieking is a(n) _____ of hunger level.

(a) Signal  
(b) Cue  
(c) Index  
(d) Attenuator

(17) The nestlings’ shrieking will convey the most information if

(a) Nestlings are almost always extremely hungry  
(b) Nestlings are rarely extremely hungry  
(c) Nestlings are extremely hungry about half the time  
(d) Parents can assess nestlings’ hunger levels accurately by looking at body size alone

(18) Parents that feed shrieking nestlings that are not, in fact, extremely hungry are victims of

(a) Deception  
(b) Exploitation  
(c) Spite  
(d) Group selection
White-breasted nuthatches (*Sitta carolinensis*) feed in groups. When predators such as hawks approach, individuals give alarm calls. Upon hearing an alarm call, a white-breasted nuthatch will flee. Sometimes nuthatches give alarm calls when no predator is present, and then, after their companions flee, enjoy some feeding time with no competition. Which of the following is a condition that, over evolutionary time, would make it LESS likely that white-breasted nuthatches would be fooled by these false alarm calls?

(a) Deceptive alarm calls are rare compared to honest alarm calls
(b) The amount of feeding time lost by fleeing in response to a false alarm call is small
(c) Given that a predator really is nearby, the likelihood of being killed is high
(d) All of the above
(e) None of the above

According to Maynard-Smith and Harper, a *signal*

(a) Could consist, for example, of one baboon pushing another away from a food source
(b) May evolve even if it benefits only the signaller, while the receiver suffers costs
(c) **Must be correct often enough for the receiver to be selected to respond to it**
(d) Could consist, for example, of the carbon dioxide exhaled by mammals, which enables mosquitoes to locate them

According to Maynard-Smith and Harper, a signal’s *strategic cost* is

(a) The cost needed to ensure that the information can be reliably received
(b) **The cost required by the Handicap Principle**
(c) The cost paid by individuals who are deceived by a false signal
(d) The cost paid by signalers whose signals are “overheard” by exploitative listeners

In choosing the duration of time segments while sampling sounds, both scientists and natural selection face a trade-off between frequency resolution and

(a) phase determination
(b) **temporal resolution**
(c) amplitude measurement
(d) acoustic impedance

If this is a *sound spectrogram*, the horizontal and vertical axes represent, respectively

(a) Time and amplitude
(b) Time and phase
(c) **Time and frequency**
(d) Frequency and amplitude
(24) The sound depicted here is

(a) A pure sine wave
(b) Amplitude modulated
(c) Frequency modulated
(d) Out of phase

(25) Animals consist mostly of solids and water. This implies that aquatic animals, compared to terrestrial and flying animals, will

(a) Be less affected by the impedance-matching problem in producing and perceiving sounds
(b) Be more affected by the impedance-matching problem in producing and perceiving sounds
(c) Be equally affected by the impedance-matching problem in producing and perceiving sounds
(d) Tend to produce sounds of lower frequency and amplitude

(26) The elephants studied by O’Connell-Rodwell et al (in your course reader)

(a) Responded only to calls with frequencies greater than 500 Hz
(b) Responded only to airborne calls
(c) Responded to seismic stimuli by clumping into tighter groups
(d) Responded to seismic stimuli by fleeing immediately

(27) The larynx of an anuran (frog or toad) differs from that of a mammal in that

(a) It is at the junction of the two bronchi with the trachea
(b) It is doubled, enabling the anuran to produce two unrelated sounds simultaneously
(c) It has separate vocal cords upstream from the glottis
(d) It makes use of stridulation to produce sounds

(28) Dichromats

(a) Are color-blind
(b) Probably perceive wavelengths of 400-600 nm as colored, and 600-750 nm as black
(c) Have human-like color vision
(d) Produce color by means of iridescent coloration
(29) Refraction of light waves at boundaries between media

(a) Follows laws similar to those governing the refraction of sound waves
(b) Allows for the evolution of organic lenses
(c) Is part of the process responsible for iridescent coloration
(d) All of the above

(30) Which of the following does NOT distinguish chemical communication from signals conveyed via light or sound?

(a) Chemical move through the environment more slowly than light waves or sound waves
(b) Chemical communication evolved more recently than auditory and visual communication
(c) Chemicals cannot be arrayed along a single linear dimension, as light and sound waves can be arrayed by frequency
(d) Any temporal pattern in chemical signals is lost at a distance, whereas sound and light signals can retain a temporal pattern at a distance

(31) Most mammals, though not apes or Old World monkeys, have a(n)

(a) Sensillum
(b) Syrinx
(c) Vomeronasal organ
(d) File and plectrum

(32) Functions of insect pheromones include

(a) Recruiting nestmates to a food source
(b) Repelling conspecifics and other insects that might compete for resources
(c) Warning conspecifics to flee from predators
(d) All of the above
(e) A and C only
(33) Suppose that you read in a news story that scientists have discovered, by studying a sample of 1000 pairs of twins, that skill at playing the video game *Grand Theft Auto IV* is “60% genetic and 40% environmental.” What does this mean?

(a) For any particular person, 60% of his/her skill is based on his/her genes, while the other 40% is based on his/her environment
(b) A person with the most common genotype has a 60% chance of being an above-average player and a 40% chance of being a below-average player
(c) The skill level of 60% of the people in the sample is caused by the individual’s genes, while the skill level of the other 40% is caused by the individual’s environment
(d) In this sample, 60% of the variation in skill level is caused by genetic variation, while the other 40% of the variation in skill level is caused by environmental variation

(34) All the following are true about white-crowned sparrow song EXCEPT:

(a) Playback experiments indicate that the birds perceive and react to dialect differences
(b) In the wild, males begin producing mature song within a few weeks of hearing it for the first time
(c) Isolation-reared, tape-tutored males acquire song only if they hear it while aged 10-50 days
(d) A male reared with a strawberry finch (a different species) learned the finch song

(35) Song sparrow song is more complex than swamp sparrow song

(a) Only when males are reared with live tutors
(b) Because song sparrows are polygynous (successful males have several mates) whereas swamp sparrows are monogamous
(c) Because song sparrows have larger brains than swamp sparrows
(d) Even when males of both species are reared in acoustic isolation

(36) Which phenomenon is NOT observed in at least some songbird species?

(a) Different songs function as alarm calls for different predators
(b) Males acquire new songs every year
(c) Individuals can mimic sounds in the environment
(d) Songs develop normally even when males are reared in acoustic isolation
SORRY. TWO ANSWERS TO QUESTION 37 ARE CORRECT, SO I GAVE CREDIT FOR EITHER ONE OF THESE TWO ANSWERS.

(37) Which statement is NOT true of the songs of male brownheaded cowbirds?

(a) Females use the “wingstroke” display to “train” males to sing songs they prefer
(b) Isolation-reared males reduce the attractiveness of their songs after being placed in large established colonies in which they are subordinate (low-ranking)
(c) Males housed with other males produce songs that females find more attractive, compared to males housed without other males
(d) Male nestlings in the wild learn their songs by listening to their fathers’ songs

(38) Vervet intergroup “wrr” calls

(a) Are first produced in their proper context at the age of 10 months, but require several more years to attain adult acoustic structure
(b) Are produced, with adult-like acoustic structure and in their proper context, by infants from the age of 2 days
(c) Differ, in their acoustic structure, between neighboring groups
(d) Have been eliminated from the vervet vocal repertoire by experimental cross-fostering procedures

(39) Chimpanzee pant-hoots

(a) Become acoustically more similar in pairs of males that associate more frequently
(b) Are not modified by experience
(c) Function as alarm calls indicating the presence of predators
(d) Are low-amplitude calls used to coordinate courtship by male-female pairs that have travelled far from the rest of the community

(40) A study of cross-fostered Japanese macaques and rhesus macaques (described in the Seyfarth & Cheney reading) found that

(a) The “food coos” of the two macaque species were very different, and cross-fostered infants produced coos resembling those of their foster mothers
(b) Cross-fostered Japanese macaque infants produced the same mixture of coos and gruffs as normally reared rhesus macaque infants
(c) Cross-fostered infants attended preferentially to their own species’ vocalizations (compared to their foster species’ vocalizations)
(d) All of the above
(e) None of the above
Seyfarth and Cheney argue that human language and nonhuman primate calls resemble each other in that

(a) In both, linkages between vocalizations and their referents are entirely learned  
(b) **Both human children and juvenile nonhuman primates go through a period of “overgeneralizing.”**  
(c) Both form part of a system of generative grammar  
(d) All of the above

Peter Marler (in your course reader) concludes that

(a) Experimental manipulations are less informative that naturalistic observations in investigating the ontogeny of birdsong  
(b) **The terms learned and innate are useful when applied to behavioral differences, but logically flawed when used to classify behaviors themselves**  
(c) The learned-innate dichotomy has encouraged biologists to overestimate genetic contributions to the development of learned behaviors.  
(d) Only when bird songs develop normally in acoustic isolation, as in the Eastern Phoebe, can they be attributed to innate knowledge

Suppose you discover that courtship displays by male scorpionflies (Macoptera) develop normally in any of the artificial environments that you create in your laboratory. From these findings alone, you could infer that this behavior

(a) Has a very high heritability  
(b) Is a product of group selection  
(c) **develops in a highly canalized fashion**  
(d) Strongly affects male reproductive success

The song-control nuclei of songbirds’ brains

(a) Grow only until the bird’s first breeding season, in all species  
(b) Are largest in species in which normal song develops without learning  
(c) **Are sexually dimorphic in size in species in which males sing more than females**  
(d) (a) and (b)  
(e) (b) and (c)

Squirrel monkey vocalizations

(a) Are controlled by brain regions homologous with (i.e. in the same relative location as) the human Broca’s area and Wernicke’s area  
(b) Do not develop properly in individuals reared in acoustic isolation  
(c) **Are controlled by brain regions in the midbrain and limbic system**  
(d) Are controlled by the HVc (higher vocal center)