**2019 National All-Star Academic Tournament**

**Round 13 – Tossups**

1. The quaternionic Hopf fibration describes the sphere of this many dimensions. The first constructed exotic sphere had this many dimensions. The Fano plane, which is the finite projective plane of order two, has this many points. This number is one *less* than the dimension of a division algebra that is noncommutative, nonassociative, but alternative. The cross product can be nontrivially defined with two arguments only in vector spaces with three or this many dimensions. This is the smallest value of *n* for which a regular *n*-gon is *not* constructible with a compass and a straight-edge. This is the number of edges in the first graph that was proven *not* to have an Eulerian path, since in the graph theory problem it is the number of bridges in Königsberg. The largest member of the only prime triplet is, for 10 points, what integer which is one less than two to the third power?  
ANSWER: **7** [or **seven**]  
*<Science Math - French>*

2. *Moderator note: read answerline carefully.* Two of these people had their 2016 funerals blocked after the church dismissed their remains, which were initially kept apart from nine others to confuse these people's supporters, as inauthentic. While being executed, several of these people had bullets bounce off of them due to diamonds sown into their underwear. Anna Anderson spent the last decades of her life impersonating one of these people. Her claim was supported by Gleb Botkin, who had become friends with these people while his father served as a court physician. One of these people was passed over for succession in favor of Grand Duke Michael due to his hemophilia, which was treated by a monk at the request of his mother, Alexandra. Along with their parents, these people were executed in the Ipatiev House in Yekaterinburg. For 10 points, name these people who included Alexei and Anastasia and made up the issue of the final monarch of Russia.  
ANSWER: **Nicholas II's Children** [accept **Nikolai** in lieu of Nicholas, accept **Nicholas II's family**, **Alexei** Romanov, Grand Duchess **Anastasia**, prompt on Romanovs, children of Tsar Nicholas, Russian Royal Family, less specific answers that seem to relate to Russian royalty]  
*<History European 1400-1914 - Myers>*

3. When this market structure exists for a homogenous product, a model of the physical limit on production that is partially named for Francis Edgeworth may emerge. An Alfred Eicher book with this structure in the title theorizes that when “megacorps” replace neoclassical firms, this market structure predominates. This market structure, which exists around a .15 to .25 Herfindahl index, may be modeled as a Stackelberg, Bertrand, or Cournot **(kor-NOH)** game, depending on which firm is the price leader. A demand curve that kinks at the prevailing price is characteristic of this market structure, whose extreme form is a duopoly. For 10 points, name this market structure in which there are very few sellers, but more than the single seller in a monopoly.  
ANSWER: **oligopoly**  
*<Social Science Economics - Weiner>*

4. The Ebbo Gospels, which were produced under this dynasty, mark early attempts at three-dimensional art in Western Europe. The duke Waifer recruited an army of Basques to oppose the expansion of this dynasty. Paul the Deacon was a historian patronized by this dynasty, and this dynasty is chronicled by five anonymous annals, including two produced at the abbeys of Lorsch and Fulda. The region of Septimania was restored to Christian control under this dynasty. A book by Henri Pirenne argues that Muslim conquests enabled the rise of this dynasty. This dynasty's lands were divided into three portions, including Lotharingia, by the Treaty of Verdun. Members of this dynasty originally gained power as “mayors of the palace” to rulers of the prior Merovingian Dynasty. For 10 points, name this dynasty founded by Charles Martel, which included a “Great” ruler who was crowned Holy Roman Emperor in AD 800.  
ANSWER: **Carolingian** Dynasty  
*<History European to 1400 - Myers>*

5. In an article published shortly after this author's death, Erica Jong recalled this poet writing her a note saying “Yes! Yes! We'll live!” This poet wrote “the wind falls in like stones / from the whitehearted water” in a poem dedicated to her mother and her father. In another poem, this author wrote “the African says: / This is the tale which I have told.” A poem by this author notes that “a woman like that is not a woman, quite” and opens “I have gone out a possessed witch.” The first poem of a collection by this author observes that “God was there like an island” and repeatedly states “I grew, I grew” and “I am rowing, I am rowing.” This author of “The Truth the Dead Know” included “Her Kind” in her collection *To Bedlam and Part Way Back*. For 10 points, name this Confessional poet of *The Awful Rowing Towards God*, who, like her friend Sylvia Plath, killed herself with carbon monoxide.  
ANSWER: Anne **Sexton**  
*<Literature American - French>*

6. According to one source, this deity was forced to pull out his hair and rip off his nails in order to reconcile with the rest of the gods. This god was so grief stricken by the death of his mother that he cried until his beard reached his stomach. In order to marry the daughter of this deity, one minor god was forced to spend a night in a room of snakes and centipedes. That son in-law later got revenge on this deity by tying his hair to the rafters. While in a contest with his sister, this god bit a sacred necklace, which turned into five men. After this Izanagi left Yomi, this deity was washed from his nose. In one instance, this god set fire to his sister's rice fields and threw a flayed horse into her weaving room, scaring a servant to death. For 10 points, name this Shinto god of the sea and storms, the brother of Tsukuyomi and Amaterasu.  
ANSWER: **Susa-no**-o-no-mikoto [or **Susanowo**]  
*<RMP Non-Greek/Roman Myth - McLain>*

7. To create one portrait, this artist flipped and superimposed the negative of a photo onto the positive image of a woman pushing her hands onto cracked glass. This photographer placed circular glass beads on a fashion mannequin's upturned face for another photo. In an image by this artist, a woman lays her white head on a table, which contrasts with a black African mask she holds. This artist of *Glass Tears* used a slinky in his best-known photogram; he used his name with the suffix “ograph” to name those photograms. His photographic subjects included the mononymous Kiki, Dora Maar, Peggy Guggenheim, and another artist's alter-ego Rrose Selavy. For 10 points, name this photographer of *Le violon d'Ingres* and images of a cross-dressing Marcel Duchamp, his fellow Dadaist.  
ANSWER: Man **Ray** [or Emmanuel **Radnitzky**; accept **rayograph**s]  
*<Arts Photography - Smith>*

8. The gay Other Fellow is imprisoned with the title character of one play set in this city, which features the song “The Auld Triangle.” In a play set in this city, a character claims to be going butterfly-catching, but leaves a bag of bombs behind in his apartment. One character in that play set in this city owns a protestant bible, which does not protect him from a raid by protestant police who drink all his liquor. In another play, the tubercular Mollser lives in a tenement in this city with the socialist Fluther Good. One character in another play set in this city frequently uses the adjective “darlin” and agrees with his drinking buddy that the world is “in a terrible state of chassis.” Joxer Daly drinks with Captain Jack Boyle in the play *Juno and the Paycock*, which is set in this city. For 10 points, name this city, the setting of a trilogy of plays by Sean O'Casey.  
ANSWER: **Dublin**, Ireland  
*<Literature British Non-Shakespeare - Myers>*

9. When a force is slightly perturbed, these entities can exhibit patterns named for Cotes or Poinsot **(pwan-SOH)**. Binet's equation describes these entities in terms of an inverted distance parameter. Bertrand's theorem establishes two types of systems which can produce closed versions of these entities. A kick and a burn are two steps to shift between these entities as shown by Hohmann. Non-ideality in these entities can be corrected by stationkeeping. An explicit equation for these entities can quickly be found by dotting the position vector with the conserved Laplace-Runge-Lenz vector. These physical entities are bounded if 1 is greater than their eccentricity. One result about the shape of these entities follows from angular momentum conservation and states that their position vectors sweep out equal areas in equal times. For 10 points, what paths are always conic sections, due to Kepler's laws?  
ANSWER: planetary **orbit**s [accept descriptions of motion under an **inverse-square** law; accept anything specifying what objects are **orbit**ing, specifically planets, moons, and satellites]  
*<Science Physics - Krol>*

10. The construction of an aquarium in one of these places in Miami was controversial due to the adverse effect of prolonged noise exposure on fish reproduction. Before relocating, one of these places was named for Charles Comiskey. The owners of one of these places sued the owners of several “rooftops” on Addison Avenue for copyright infringement before officially partnering with some of them. A two-pound chicken tender is only available at one of these places. A building of this type that served as a model for most others constructed since the 1990s was built at Baltimore's Camden Yards. The first domed building of this type was built in Houston in 1965 and is the namesake of a type of artificial grass frequently used in these places. For 10 points, name these places that include Wrigley Field, Fenway Park, and the Astrodome.  
ANSWER: baseball **stadium**s [accept **ballpark**s]  
*<Geography US - Myers>*

11. Methylmercury was found to be the cause of two toxicological disasters in this country resulting in patients developing tinnitus and tunnel vision. Locals in one region of this country coined the term itai-itai for the severe pain they experienced due to cadmium poisoning from mining runoff. Environmental pollution by improper handling of industrial wastes by corporations in this country serves as the etiology for its four big pollution diseases. A 2008 study suggested that a nuclear plant in this country needed better protection from tsunamis due to its proximity to the coast. A frozen soil barrier was constructed to prevent groundwater contamination by radiation after an earthquake struck this country in March 2011. The Fukushima Daiichi nuclear disaster happened in for 10 points what country where the atomic bombings of Hiroshima and Nagasaki took place.  
ANSWER: **Japan**  
*<Science History of Science - Rao - Pothuraju>*

12. One poetry collection in this language begins by comparing love to “the archipelago,” “a song,” and “a ship.” The Generation of the '30s was an intellectual movement that influenced many poets writing in this language. One poet in this language stopped writing for 10 years, then returned in 1959 with a book-length poem that would later be set to music, *Worthy It Is*. The collection *Orientations* was written in this language. One poem in this language encourages the addressee to “hope your road is a long one” while going to the title island. Another poem by the same author in this language asks “why are the senators sitting there without legislating?” and ends “they were, those people, a kind of solution.” For 10 points, name this language used to write “Waiting for the Barbarians” and “Ithaka” by Constantine Cavafy, as well as the poems of Odysseus Elytis.  
ANSWER: Modern **Greek** [or **Ellenika**]  
*<Literature European - Myers>*

13. In a story in this text, a guide uses magic to create a temporary city as respite for weary travelers in search of treasure, before making the city vanish. The phrase “Namu Myōhō Renge Kyō” is repeatedly chanted by those who honor this text. Zhiyi wrote prolifically about this text, and he is often considered to be the founder of the Tiantai School that venerates this text. Sariputra is depicted as slow-witted in this text, though his mind is said to have “danced with joy” after being promised Buddhahood. In this text, the idea of *upaya* is illustrated with a parable in which a father promises toy carts to his children in order to get them to leave a burning house. This text's central idea that anyone can achieve Buddhahood has influenced many East Asian Buddhist traditions. For 10 points, identify this Mahayana text named after a flower.  
ANSWER: ***Lotus*** *Sutra* [or ***Myōhō Renge Kyō*** until mention]  
*<RMP Non-Christian/Bible Religion - Suh>*

14. A 1962 multi-national agreement upholding a coalition government in this country was signed after John F. Kennedy dismissed this country as “not worthy of engaging the attention of great powers”. A member of this country's royal family nicknamed the “Red Prince” led a guerrilla group during its civil war. A 1972 book by Fred Branfman exposed US atrocities in this country, and a 1997 book by Anne Fadiman about refugees from this country features Vang Pao, a general who fought against a guerrilla group in this country named Pathet [this country]. This country was targeted in the heaviest bombing campaign in history, resulting in thousands of unexploded bombs in this country's Plain of Jars. The CIA conducted the “Secret War” in this country as part of a 20th century conflict centering on a neighboring nation. For 10 points, name this country, the origin of thousands of Hmong refugees.  
ANSWER: **Laos** [or **Lao People's Democratic Republic**; accept **Muang Lao**, **Kingdom of Laos**, or **Royaume du Laos**]  
*<History World - Singh>*

15. Walter Damrosch commissioned this composer's final work, which this composer explained to his publishers with a quatrain about “the forest's mighty god.” Tristan Murail's *Gondwana* quotes movement two of a collection by this composer whose first movement depicts its subject “and the Maidens of the Island”. That second movement of a suite by this composer is in 9/4 and features an English horn solo. This composer recycled material from his unfinished Wagnerian opera *The Building of the Boat* in that composition. A piece made for the 1899 Press Celebrations by this composer features a “hymn” melody that was adapted into “Be Still My Soul.” This composer of *Tapiola* created a nationalistic piece often titled *A Scandinavian Choral March* to deceive Russian censors. For 10 points, name this composer of “The Swan of Tuonela” and *Finlandia*.  
ANSWER: Jean **Sibelius**  
*<Arts Music - Smith>*

16. Saul Kripke's theory of this concept allows for its predicate to be defined within a language using “fixed-point semantics” based on infinite iteration on the first order of sentences with this property. Strawson argued that this predicate is redundant and already communicated by assertion. In “How to Make Our Ideas Clear,” Charles Sanders Peirce **(PURSE)** theorizes that this concept can only be defined as the consensus arrived at after inquiry. Nozick proposed a theory for “tracking” this concept as a reaction to situations that are both justified and have this quality but are not considered knowledge known as Gettier problems. The idea that this concept is the proper alignment between language and reality is the “correspondence theory” of it, which is in contrast to Tarski's semantic theory of this concept. For 10 points, name this concept usually opposed to falsehood.  
ANSWER: **truth**  
*<RMP Philosophy/Thought - Marvin>*

17. In a poem about this person, the speaker claims that no one in the world “knows well” to “shun the heaven” that this person offers. Two poems about this person were originally published in a collection entitled *The Passionate Pilgrim*. In another poem about this person, the speaker admits to betraying his “nobler part” to his “gross body's treason.” Alfred Leslie Rowse used the diaries of the court astrologer Simon Forman to theorize that the identity of this person was the poet Emilia Lanier. This woman is said to “tread on the ground” in a poem in which her hair is compared to “black wires.” A sequence of poems about this woman follows a sequence about a “fair youth,” with whom this woman supposedly had a liaison. For 10 points, name this woman “whose eyes are nothing like the sun,” the subject of many William Shakespeare sonnets.  
ANSWER: **dark lady**  
*<Literature Shakespeare - Husar>*

18. Radini et al. discovered traces of this material in a medieval woman's teeth, suggesting that women were more involved in producing illuminated manuscripts than previously thought. The Indus river valley civilization created beads out of this material, which they mined from the Chagai hills in southern Balochistan. Chariots of red limestone are depicted in front of a background of this material in the *Standard of Ur*. The ancient Egyptians decorated scarabs and other amulets with a synthetic pigment that they called an “artificial” form of this material, since this material itself had to be imported from Afghanistan. Titian's *Bacchus and Ariadne* uses an exorbitant amount of an expensive pigment made from this material that was typically used only to depict the robes of the Virgin Mary. For 10 points, name this material used to create ultramarine, a blue gemstone.  
ANSWER: **lapis** lazuli [accept **ultramarine** during the first sentence]  
*<Arts Painting - French>*

19. Microdeletions in the AZF region cause this process to not occur in Del Castillo syndrome. During the first stage of this process, type A pale cells divide to produce an intermediate, while type A dark cells maintain a supply of stem cells required for this process. The proteins ICAM-1 and ICAM-2 antagonize tight junctions forming a structure important in this process, allowing certain intermediates in this process to cross that structure. Sertoli cells secrete ABP to enhance the ability of this process to occur and to support the products of this process. This process requires a temperature several degrees Celsius lower than body temperature to occur. This process takes place in the lumen of the seminiferous tubules. The products of this process contain an acrosome and a flagellum. For 10 points, name this process which produces male gametes.  
ANSWER: **spermatogenesis** [or **spermatidogensis** or **spermatocytogensis**; accept equivalents like **sperm production**, prompt on gametogenesis]  
*<Science Biology - Rombro>*

20. A series of treaties named for this president established a Joint High Commission to arbitrate disputes between the US, Britain, and France. As a governor, this man integrated his civil service by appointing Cayetano Arellano. This man appointed Douglas MacArthur's father as his assistant while serving as governor-general of the Philippines. This president's secretary of the interior, Richard Ballinger, feuded with the conservationist Gifford Pinchot. After losing an election, this man became the only president to become a supreme court justice. This president won only Utah and Vermont in a three way election against his Democratic successor and his predecessor, who ran with the Bull Moose Party. For 10 points, name this famously rotund president who succeeded Theodore Roosevelt.  
ANSWER: William Howard **Taft**  
*<History American (1865-1945) - Myers>*

21. A type of tomb that depicted an effigy of the deceased as a living person above one of the deceased as a corpse became widespread after this event. *Gesslerlieder* were composed by one religious movement that became widespread during this event. A chronicle compiled by John Clyn ends during this event with the words “here, it seems, the author died.” The brothers Luchino and Giovanni Visconti introduced measures such as immurement and targeted burning that succeeded in easing the effects of this event. The Statute of Laborers controlled wages in the aftermath of this event, which caused the value of labor to rise dramatically. A movement of religious extremists called flagellants spread during this event. This event began after Mongols catapulted bodies over Genoese defenses at the Siege of Caffa. For 10 points, name this epidemic of bubonic plague that led to the death of 1/3 of Europe's population.  
ANSWER: **black death** [accept ***Y. Pestis*** epidemic, **black plague**, prompt on **bubonic plague**]  
*<History European to 1400 - French>*

**2019 National All-Star Academic Tournament**

**Round 13 – Bonuses**

1. The quantum analogue of this law, which applies instead to the expected values of the quantities concerned, is the simplest version of Ehrenfest's theorem. For 10 points each:  
[10] Name this law, which states that the rate of change of momentum is directly proportional to the force applied. If one assumes the mass is constant, then it can be restated in the familiar form 'F equals m a'.  
ANSWER: **Newton's Second** Law of Motion [or clear equivalents, prompt on partial]  
[10] If one instead allows the mass to vary, then by carefully considering when the system is closed, Newton's Second Law yields this foundational equation in rocket science. It states that the change in velocity is proportional to the logarithm of the ratio of initial and final rocket masses.  
ANSWER: **Tsiolkovsky** rocket equation [prompt on rocket equation]  
[10] Going one stage further and treating the situation relativistically, the rocket's change in velocity is instead proportional to this function of the logarithm of the ratio of the masses. The relativistic beta, v over c, is equal to this function of the rapidity.  
ANSWER: **tanh** [pronounced 'tanch' or 'than'; accept **hyperbolic tan**gent; do NOT accept or prompt on tangent alone]  
*<Science Physics - Krol>*

2. The fourth century was a particularly tumultuous time for Christianity in the Roman Empire. For 10 points each:  
[10] This term described those who willingly gave away their Christian religious texts or identities of fellow believers to Roman authorities to escape the persecution of Diocletian. Felix of Aptungi was accused of being one of these people, which led to the Donatist controversy.  
ANSWER: ***traditor***  
[10] A dispute over the relationship between God and Jesus Christ occurred in this controversy, which contrasted with the Nicene Creed and argued that Jesus Christ was a demigod.  
ANSWER: **Arian** controversy  
[10] Athanasius of Alexandria, who argued that the Arian Creed turned Christianity into polytheism, was exiled twice before he identified the 27 books that are currently used in this second part of the Biblical canon, which includes the Gospels and epistles.  
ANSWER: **New Testament**  
*<RMP Christian/Bible Religion - Jankov>*

3. This leader signalled the beginning of the rebellion that brought him to power by using runners to send out knotted cords to neighboring towns. For 10 points each:  
[10] Name this leader who expelled Spanish missionaries and restored the ritual use of katsina dolls after a 1680 revolt made him the leader of a state centered on Ohkay Owingeh.  
ANSWER: **Popé** **(Po-PAY)** [accept **Po'pay**]  
[10] Popé led a revolt named for these people native to modern New Mexico, who lived in namesake “towns” that often featured cliff dwellings.  
ANSWER: **Pueblo** [or **Puebloans**; accept **Anasazi**, **Tewa**]  
[10] Pekka Hämäläinen **(Ha-ma-lie-nen)** argues that after the Pueblo Revolt, Spanish New Mexico functioned as a tributary of this Native American group. This group led by Quanah Parker established an empire in the Southwest before their power was broken when Texan forces killed their leadership at a peace meeting in the Council House Fight.  
ANSWER: **Comanche** [accept **Comancheria**, **Numunuu**]  
*<History American (pre-1865) - French>*

4. In one story, this character nails a deuce of clubs to a tree above the epitaph, “he hit a streak of bad luck and handed in his checks”. For 10 points each:  
[10] Name this character who saves “the Innocent” from gambling debts before being kicked out of a gold camp. In another story, he is described as having “the melancholy air and intellectual abstraction of a Hamlet” while playing cards in a room where a woman dies while giving birth, leaving the room's denizens to raise the child.  
ANSWER: **John** **Oakhurst**  
[10] Both of those stories were written by this author, who published them and his anti-Chinese satirical poem “Plain Language from Truthful James” in the *Overland Monthly*.  
ANSWER: Bret **Harte**  
[10] Almost all of Bret Harte's works, including “The Luck of Roaring Camp” and “The Outcasts of Poker Flat”, were set in this state, in which the *Overland Monthly* was published. While living in this state, John Muir also contributed to the *Monthly*.  
ANSWER: **California**  
*<Literature American - Myers>*

5. A variant of the *huqin* called the *jinghu* is often used as accompaniment in this theatrical genre. For 10 points each:  
[10] Name this theatrical genre in which the Four Dan Actors and Four Dan Actresses specialized. This genre includes *The Peony Pavilion* and *Farewell My Concubine*.  
ANSWER: **Beijing** opera [or **Peking** opera; or **jing ju**; or **guo ju**; or **xìqǔ**; prompt on Chinese opera]  
[10] This “model opera” is performed within John Adam's *Nixon in China*. This opera-ballet is interrupted by the First Lady, who thinks that a peasant girl is going to be whipped to death,  
ANSWER: *The* ***Red Detachment of Women*** [or ***Hóngsè niángzǐ jūn***]  
[10] Pat Nixon's interruption of *The Red Detachment of Women* prompts this indignant coloratura aria that has become a signature of Kathleen Kim. It contains several repetitions of “the book” and brags about a man “who raised the weak above the strong.”  
ANSWER: “**I am the wife of Mao** Tse-tung”  
*<Arts Opera - Smith>*

6. J. Anthony Lukas described the experience of the Twymon, McGoff and Divers families, who experienced busing in this city, in his book *Common Ground*. For 10 points each:  
[10] Name this city in which W. Arthur Garrity laid the foundation for a program of compulsory busing in *Morgan v. Hennigan*.  
ANSWER: **Boston**, Massachusetts  
[10] The anti-busing protests in Boston saw Joseph Rakes attack Ted Landsmark with one of these objects, as depicted in the photograph *The Soiling of Old Glory*.  
ANSWER: American **flag**  
[10] This Massachusetts senator was criticized for supporting busing but sending his children to private schools. After a failed presidential challenge, this man gave the “Dream Shall Never Die” speech.  
ANSWER: **Edward** “Ted” **Kennedy** [accept **”Ted” Kennedy**]  
*<History American (1945-present) - Jackson>*

7. In one play by this author, Waitwell pretends to be Sir Rowland and, on Mirabell's command, tries to trick Lady Wishfort into a false engagement. For 10 points,  
[10] Name this author who created the sayings “hell hath no fury like a woman scorned” and “kiss and tell” in plays like *The Way of the World*.  
ANSWER: William **Congreve**  
[10] The Way of the World was a play from this period which had no rules governing its morality. Comedies in this period were also known as comedies of manners and this period saw the first professional female playwright, Aphra Behn.  
ANSWER: **Restoration** [accept **Restoration** comedies]  
[10] This 1676 Restoration comedy by Sir George Etheredge subtitled Sir Fopling Flutter follows Dormiant extricating himself from his affair with Mrs. Loveit to marry Harriett.  
ANSWER: *The* ***Man of Mode***  
*<Literature British Non-Shakespeare - Santanam>*

8. This artist's painting *There Comes Papa* has been read as a commentary on the upheaval of Nayar gender roles under British rule. For 10 points each:  
[10] Name this artist. He is best known for his paintings of scenes from the *Mahabharata* and the *Recognition of Shakuntala*.  
ANSWER: Raja Ravi **Varma**  
[10] Varma's *Mahabharata* paintings can be classified into this broad genre, since they depict scenes from myth. In Western academies, this genre of painting was typically placed at the top of the hierarchy of genres.  
ANSWER: **history** painting  
[10] Many of Varma's paintings were first introduced to a Western audience at an exhibition in this city. This city's Art Institute contains *A Sunday Afternoon* and *Paris Street, Rainy Day*.  
ANSWER: **Chicago**, Illinois  
*<Arts Painting - Myers>*

9. For 10 points each, answer the following about the EM algorithm for parameter estimation:  
[10] The EM algorithm involves computing the expected value of this function with respect to the current parameter estimates. This function, whose derivative is the score function, commonly arises in frequentist parameter estimation, since it can be easier to solve for the MLE after applying a certain monotonic transformation.  
ANSWER: **log-likelihood** function [accept any answer indicating that it is the **log**arithm of the **likelihood** function; do not accept or prompt on just “likelihood”]  
[10] Because it iteratively increases the log-likelihood of the observed data, EM has a tendency to move toward this type of optimum. This type of optimum may only be the best solution in some neighborhood, in contrast to a global optimum.  
ANSWER: **local** optimum  
[10] The EM algorithm is commonly used to estimate the parameters of one of these models, in which data is assumed to come from one of many different distributions, each with a certain probability.  
ANSWER: **mixture** model [do not accept or prompt on “mixed” model]  
*<Science Math - Morrison>*

10. After this battle ends, Mopsus sees a rising golden bird, which may be a phoenix. For 10 points each:  
[10] Name this battle that sees the death of Caeneus, a warrior who was mocked by Latreus for being transformed from a woman into a man. This battle begins as Eurytion is killed by Theseus, who smashes a wine-bowl in his face.  
ANSWER: **Centauromachy** [or the **battle** between the **centaurs** and **Lapiths**; prompt on partial answers or answers indicating a battle between Greeks and centaurs; accept, but do not otherwise reveal, the **battle** at **Pirithous's wedding**]  
[10] The battle between the centaurs and the Lapiths occurs at the wedding of this King of the Lapiths. He isn't Pelops, but Euryteus provokes Theseus by attempting to carry off this man's wife, Hippodamia.  
ANSWER: **Pirithous**  
[10] The Bassae Frieze depicts both the Centauromachy and a battle between Greeks and these peoples, a fierce woman warrior race led at various times by Penthesilea and Hippolyta.  
ANSWER: **Amazon**s [accept the **Amazonomachy**]  
*<RMP Greek/Roman Myth - Shanmugam>*

11. This leader signed the Treaty of Resht with Russia and looted the Peacock Throne from Delhi. For 10 points each:  
[10] Name this leader whose idolization of prior conquerors such as Genghis Khan and Tamerlane led him to invade India and the Ottoman Empire in the mid-18th century  
ANSWER: **Nader** Shah  
[10] Nader fought a battle against a Mughal vassal state while marching across this pass, which separates modern Afghanistan and Pakistan. His victory there allowed him to conquer much of Northern India.  
ANSWER: **Khyber** Pass  
[10] Ahmad Shah, the first leader of this empire, declared independence from Nader Shah once his grip on his empire began to weaken. This empire is considered a predecessor state of modern Afghanistan and fought the Maratha confederacy at the Third Battle of Panipat.  
ANSWER: **Durrani** empire [or **Sadozai** kingdom]  
*<History World - French>*

12. This composer's output was divided into three periods, the last of which is a period of “Contrition,” by his foremost scholar. For 10 points each:  
[10] Name this composer whose music popularized a hybrid instrument called the tromboon. His operas include *The Abduction of Figaro* and the half-act *The Stoned Guest*, which were popularized on albums by Peter Schickele.  
ANSWER: **P.D.Q. Bach** [prompt on Bach; prompt on Peter Schickele before mention]  
[10] A “humorous duet” for two of these animals has been attributed to Rossini, but was likely written by Robert Lucas Pearsall. A G minor fugue by Domenico Scarlatti is popularly named after this animal.  
ANSWER: **cat**s [or **gatto** or **gatti**]  
[10] Gerard Hoffnung's namesake festivals, which were hosted in this city, included such pieces as the *Surprise Symphony* “with extra surprises.” The Proms are held in this city's Royal Albert Hall.  
ANSWER: **London**  
*<Arts Music - Smith>*

13. A couple is told that their daughter has been killed by a drunk driver, but they are relieved to find out that the body is actually that of her friend in this author's story “Chicxulub.” For 10 points each:  
[10] Name this author. Both men agree not to call an ambulance when Delaney injures Cándido while driving his car in this author's novel *The Tortilla Curtain*.  
ANSWER: T. C. **Boyle** [or Thomas Coraghessan **Boyle**]  
[10] Mel tells Nick and Laura about an elderly couple hit by a drunken teenager in this short story. In this story, Terri claims that her abusive ex-boyfriend Ed really did love her while sharing a bottle of gin with friends.  
ANSWER: “**What We Talk About When We Talk About Love**”  
[10] T. C. Boyle's “Chicxulub” and Raymond Carver's “What We Talk About When We Talk About Love” were both originally published in this magazine. This Manhattan-based magazine also published Shirley Jackson's “The Lottery” and employed James Thurber.  
ANSWER: The **New Yorker**  
*<Literature American - French>*

14. A 2019 *New York Times* article discussed the controversy over genetic research done by David Reich's lab on ancient skeletons found in this culture's Teouma site in Vanuatu. For 10 points each:  
[10] Name this cultural complex from the Pacific, often thought to be the ancestors of most modern Pacific islanders. It was characterized by its widespread use of dentate-stamped pottery.  
ANSWER: **Lapita** culture  
[10] Another hallmark of the Lapita culture is the widespread use of this rock to make tools. Artifacts made from this kind of dark volcanic glass can be dated using a form of hydration dating.  
ANSWER: **obsidian**  
[10] Experimental archaeologists often try to replicate methods used in this practice of applying lithic reduction to stones like flint or obsidian to create tools.  
ANSWER: **knapp**ing  
*<Social Science Anthropology - Kothari>*

15. FAIRE-seq and DNase-seq are alternatives to the pairing of this technique with next generation sequencing. For 10 points each:  
[10] Name this technique, which is often paired with a microarray to form a technique with a redundant nickname that is used in mapping the cistrome. Rabbits are one source for monoclonal antibodies used in this technique.  
ANSWER: **ChIP** [or **chromatin immunoprecipitation**; accept **ChIP**-Seq or **ChIP**-on-chip or **ChIP**-chip]  
[10] After running ChIP, the quantitative form of this technique can be used to measure the products. This technique, which is used to reproduce many strands of DNA, uses *taq* polymerase for its ability to withstand high temperatures.  
ANSWER: quantitative **polymerase chain reaction** [or q**PCR**]  
[10] An alternative to ChIP-Seq, called DamID, uses the *dam* protein to perform this modification on DNA. Bisulfite sequencing detects this modification, which occurs often at CpG islands.  
ANSWER: DNA **methylation**  
*<Science Biology - Shanmugam>*

16. Salum Bar'wani was the first MP elected to his country's parliament from this group. For 10 points each:  
[10] Name this group, frequently targeted by hate crimes in East Africa so that witch doctors can harvest their body parts, which are thought to have magic powers. The first beauty pageant exclusively for people of this group took place in Nairobi in December 2018.  
ANSWER: **albino**s [accept people with **albinism**]  
[10] Salum Bar'wani was elected to parliament in this country, where he represents a party that opposes President John Magufuli in an assembly at Dodoma.  
ANSWER: **Tanzania**  
[10] Besides witch doctor killings, albinos in East Africa are also affected by this nomadic ethnic group's tradition of infanticide of albino babies. This ethnic group, whose traditional shields are depicted on the Kenyan flag, names a national park in Kenya contiguous with Tanzania's Serengeti.  
ANSWER: **Maasai**  
*<Current Events Non-US - Myers>*

17. The depth of the well of this potential is the dissociation energy, while its position on the x-axis is the distance between the nuclei. For 10 points each:  
[10] Name this potential, which is used to model diatomic molecules. For small vibrations, this potential can be approximated with a quantum harmonic oscillator, but as bond length increases this potential tends towards a horizontal asymptote.  
ANSWER: **Morse** potential  
[10] The Morse potential can be approximated by a QHO since its well roughly has this shape. The graph of *y* equals *x* squared has this shape.  
ANSWER: **parabola** [or **parabolic**]  
[10] Although the depth of the Morse potential well is called the dissociation energy, the actual energy required to dissociate is slightly less, due to the presence of this energy. This energy arises because the Heisenberg uncertainty principle prevents the actual internuclear distance from aligning exactly with the bottom of the well.  
ANSWER: **zero-point** energy  
*<Science Chemistry - French>*

18. According to this book, the only good thing which is not derivative is the good will. For 10 points each:  
[10] Name this book which distinguishes between acting from duty and acting in accordance with duty. This book famously argues that all hypothetical maxims should be brought into line with how a kingdom of ends would legislate.  
ANSWER: ***Groundwork of the Metaphysics of Morals*** [accept ***Foundations of the Metaphysics of Morals*** or ***Grounding of the Metaphysics of Morals*** or ***Grounding for the Metaphysics of Morals*** or ***Grundlegung zur Metaphysik der Sitten*** or ***Groundwork for the Metaphysics of Morals***]  
[10] *The Groundwork of the Metaphysics of Morals* uses the afforementioned categorical imperative as the basis for this type of ethical system. This type of ethics assumes that actions are right or wrong based on norms, duties, or rules, rather than consequences.  
ANSWER: **deontological** [accept word forms]  
[10] This philospher wrote the *Groundwork of the Metaphysics of Morals*. This thinker outlined his philosophy in his three critiques, which include the *Critique of Practical Reason* and the *Critique of Pure Reason*.  
ANSWER: Immanuel **Kant**  
*<RMP Philosophy/Thought - McLain>*

19. A scene in *Crime and Punishment* in which Raskolnikov tries to stop the flogging of a horse bears a striking resemblance to a common anecdote about this thinker in Turin. For 10 points each:  
[10] Name this thinker, whose relationship to Dostoevsky is the subject of a book-length study by Lev Shestov. *Crime and Punishment* is frequently read in contrast to the idea of the ubermensch presented in his book *Thus Spake Zarathustra*.  
ANSWER: Frederich **Nietzsche**  
[10] *Note to players: Description acceptable* Time in the philosophical circle of Vissarion Belinsky inspired this Dostoevsky character, who objects to Nikolai Chernyshevsky's “Crystal Palace” metaphor. This man also rails against the unchangeable reality of the equation “2 plus 2 equals 4.”  
ANSWER: the **Underground Man** [or descriptions such as the **narrator** / **protagonist** of ***Notes from Underground*** / ***Notes from the Underground*** / ***Letters from the Underworld***]  
[10] Belinsky appears in *Voyage* and *Shipwreck*, two parts of this 2002 trilogy of plays whose principal characters are Russian thinkers such as Mikhail Bakunin and Alexander Herzen.  
ANSWER: *The* ***Coast of Utopia*** (by Tom Stoppard)  
*<Literature European - Smith>*

20. *Description acceptable* For his actions towards this goal, Dimitar Peshev was posthumously known as “Righteous Among the Nations.” For 10 points each:  
[10] Name this goal that was achieved in opposition to Alexander Belev during World War II. Bishop Kiril supposedly stood in front of trains to help achieve this goal, whose accomplishment was unique in Nazi-allied countries.  
ANSWER: **saving Bulgarian Jews** from the Holocaust [accept anything about preventing **Jews** from **Bulgaria** being **deported** for the Holocaust or concentration camps; prompt on answers that don't mention **Bulgaria** with “from what country?”]  
[10] This tsar of Bulgaria during World War II was convinced to change his mind and protect his country's Jews. This ruler came to power by defeating the Zveno movement.  
ANSWER: **Boris III** [prompt on Boris]  
[10] After allying with the Nazis, Boris III's government took control of the this modern-day country. A naming dispute with Greece resolved in 2019 has long barred this country's accession to NATO.  
ANSWER: Republic of North **Macedonia**  
*<History European 1914-present - Shanmugam>*

21. A spurious half-measure is often added to versions of this piece with its popular but slightly incorrect name, thus leading it to end on middle C. For 10 points each:  
[10] Name this piece often played with just the left hand, the second in the opus numbered 117 by Wotquenne. The best-known piece of the foremost “sensitive style” composer, this monophonic “little study” in C minor appears in many piano pedagogy book since it helps students learn to play even sixteen notes while alternating hands.  
ANSWER: ***Solfeggietto*** in C minor [or ***Solfeggio*** in C minor] (by C.P.E. Bach)  
[10] *Solfeggietto* composer C.P.E. Bach worked for both this musician and his sister Anna Amalia. This composer and flautist gave Johann Sebastian Bach the theme used to create *The Musical Offering*.  
ANSWER: **Frederick the Great** [or **Frederick II** von Hohenzollern; prompt on Frederick or Friedrich]  
[10] C.P.E. Bach's “sensitive style” falls within this broader, exceptionally ornate style in the visual and musical arts often synonymous with “Late Baroque.”  
ANSWER: **rococo** [or style **rocaille**]  
*<Arts Music - Smith>*