1. While consulting a plywood manufacturer, a mathematician from this country developed a method of finding "objectively determined valuations" or "shadow prices" for goods through linear programming. In the article "Plans, Profits, and Bonuses," an economist here argued for using profit rather than output as an indicator of economic success. Paul Samuelson's *Economics* textbook contained predictions of when this country's GNP would surpass that of the United States that kept being pushed back in later editions. Joseph Schumpeter named 50 year-long economic growth waves after a man from here who supported a policy allowing small private enterprises during the 1920s. Gosplan was in charge of setting production quotas in this country, and its more long-term economic policies were laid out in Five-Year Plans. For 10 points, name this former Communist country.
ANSWER: **Soviet Union** [or **USSR**; or **Union of Soviet Socialist Republics**] <Bailey>

2. Enemark-Feltham notation is used for ligands containing these two elements. These two elements combine in the first step of the Birkeland-Eyde synthesis. Another compound of them decomposes above negative 100 degrees Celsius from blue to green to brown. The simplest compound of them is synthesized from arginine and NADPH in an enzyme complex with five cofactors. A dimerized radical with bond order 1.5, containing these two elements, may be used for rocket fuel. A compound of chlorine and these two elements produce the yellow color of aqua regia. Three electron-withdrawing groups containing these elements are found in TNT. For 10 points, name these elements which constitute 99% of our atmosphere.
ANSWER: **nitrogen** and **oxygen** [or N_2 and O_2; prompt on partial answer] <Silverman>

3. This place houses a garden whose two guardians fail to realize that a swarm of ants are stealing away four bowls' worth of flowers. Residents of this place have their names revealed when a mosquito stings each of them one by one. This locale is home to a pitch-black chamber in which visitors must stay the night without their torch or cigars burning out. A visitor to this location uses a squash as a replacement for his head after he is decapitated by a screeching bat. This place contains several traps such as Razor House, Jaguar House, and Bat House. One Death and Seven Death are two of the lords of this realm that are defeated in a ball game by the Hero Twins, Hunahpu and Xbalanque (shuh-buh-LAWN-kay). For 10 points, name this Mayan underworld.
ANSWER: **Xibalba** [prompt on **Mayan underworld** before "Mayan underworld" is read; prompt on **underworld** before "underworld" is read] <Kim>

4. This organization fought with troops called "Ruff Puffs" as well as the FULRO, which was made up of members of the Montagnard tribe. This group was targeted by Rome Plows in an area where it set up many pengi sticks, called the Iron Triangle. Agroville communities were built to oppose this group as part of a plan replaced by the Strategic Hamlet Program. An alleged stronghold of this group was codenamed Pinkville. Troops called "tunnel rats" explored this group's underground networks. This group was the target of Operation Ranch Hand, which used Agent Orange against it. and it also fought William Westmoreland's troops in the Tet Offensive. For 10 points, name this group which waged guerrilla warfare for North Vietnam during the Vietnam War.
ANSWER: **Viet Cong** [or **NLF**; or **National Liberation Front**; prompt on related answers like "PAVN," "People's Army of Vietnam," "North Vietnamese Army," or "Viet Minh"] <Brownstein>

5. In this city, a man told musician Ben Branch to play the song "Take My Hand, Precious Lord" shortly before going outside for a cigarette. In a speech here, a man admitted "I would like to live a long life—longevity has its place." At a Mason Temple in this city, a man announced "I'm not fearing any man—my eyes have seen the glory of the coming of the Lord!" Andrew Young and Jesse Jackson are photographed pointing while on a hotel balcony in this city. While here to support striking sanitation workers, a man gave the "I've Been to the Mountaintop" speech. A man was killed at the Lorraine Motel in 1968 in this city by James Earl Ray. For 10 points, name this Tennessee city where Martin Luther King Jr. was assassinated.
ANSWER: **Memphis** <Cheyne>

6. While living in Parma, this artist painted a red-headed woman with her hand on the shoulder of a woman wearing a gold head scarf in *Two Women Throwing Flowers During Carnival*. A lost mural painted by this artist for the World's Columbian Exhibition depicted *Women Plucking the Fruits of Knowledge*. This artist's mother reads the newspaper *Le Figaro* in a portrait. This artist painted Mary Ellison in *Woman with a Fan*. A woman in a pink, white, and green-striped shirt dips a child's foot in a bowl in a painting by this artist, who depicted a woman in a gold dress with a sunflower on her chest holding a child who looks at herself with a mirror. For 10 points, name this American Impressionist painter of *The Bath* and *Mother and Child*.
ANSWER: Mary **Cassatt** [or Mary Stevenson **Cassatt**] <Douglass>

7. In a sonnet by this author, a physician recalls how he used "a slight kind of engine" and asks, "You wouldn't hang me? I thought not." This poet described a man who "lifted up his voice and sang, secure, with only two moons listening, until the whole harmonious landscape rang" with the words "for auld lang syne." This poet's popularity peaked in the 1920s, a decade in which he won three Pulitzer prizes. This poet of "How Annandale Went Out" wrote about a drinker who "mourned Romance, now on the town, and Art, a vagrant." He also wrote about a "gentleman from sole to crown" who, "one calm summer night, went home and put a bullet through his head." For 10 points, name this American poet of "Mr. Flood's Party" and "Richard Cory."
ANSWER: Edwin Arlington **Robinson** <Casalaspi>

8. A woman in this work has her pearls stolen by her husband before he elopes to South America with a Spanish dancer. In this work, Val fights in the Boer War after being dared to enlist by Jolly. The title character of its first book chooses to save the baby Fleur's life over the life of the baby's mother, Annette Lamotte, but is later upset when Fleur falls for his ex-wife's son Jon. The young architect Philip Bosinney travels to Robin Hill to design a house for the title family of this series, whose members include Old Jolyon, Young Jolyon, and Soames. For 10 points, name this series of novels consisting of *The Man of Property*, *In Chancery*, and *To Let*, written by John Galsworthy.
ANSWER: The **_Forsyte Saga_** <Sy>

9. Some restaurants in this country's capital sell "Happy Pizza," which is topped with marijuana. Andre Malraux was once arrested for stealing a bas-relief from a site in this country. This country's residents celebrate the water festival Bon Om Touk, during which a human stampede killed 347 people in 2010. This country's western border was fortified by the K5 Plan, leading to deforestation in the Cardamom Mountains. A high school in this country was converted into a prison camp known as S-21. Siem Reap is an entry point to a large temple complex in this country built by Suryavarman II. For 10 points, name this Southeast Asian country home to the Khmer people and Angkor Wat.
ANSWER: **Cambodia** [or Kingdom of **Cambodia**; or Preah Reacheanachak **Kampuchea**] <Golimlim>

10. The namesake factor of this phenomenon is raised to the power of either two or three plus the spectral index in the equation for relativistic beaming. This effect causes boosting in blazars because of its strong dependence on the peak frequency. The namesake relativistic factor of this phenomenon depends only on the viewing angle and the Lorentz factor. This effect caused canal rays reflected by a concave mirror oriented at 7 degrees to have slight changes to their spectral lines, as measured by Ives and Stilwell. A proof of special relativity is the existence of this effect's transverse form. For 10 points, name this phenomenon in which different source and receiver velocities causes the observed frequency of a wave to shift.
ANSWER: **Doppler** effect [or **transverse Doppler** effect; or relativistic **Doppler** effect; prompt on special **relativity**] <Silverman>

11. Genre and composer required. The fourth of these pieces begins with violins playing a descending "B, G," then an ascending "E, C." The third of these pieces includes a waltz-like third movement in C minor and 3/8 time, marked *Poco allegretto*. Their composer likened a horn solo in the finale of the first one to an alphorn melody. The third of these pieces, in F major, opens with an ascending "F, A-flat, F" motif that represents the idea "free but happy." The last one ends with a passacaglia based on the bass line to a J.S. Bach cantata. The first of these pieces contains a theme so similar to the "Ode to Joy" theme that it was nicknamed "Beethoven's Tenth." For 10 points, name these four orchestral pieces by the composer of the *Hungarian Dances*.
ANSWER: **symphonies** by Johannes **Brahms** <Kim>

12. An aristocrat with this name, the rival of Plancina, gained prestige for rallying forces in the land of the Treveri, where monuments were constructed in honor of her puerperium. For fear of poison, a person with this name offended an Emperor by refusing an apple. After being arrested, that person with this name and her son Drusus both starved to death. Another noblewoman with this name allegedly arranged the poisoning of Claudius. Several accounts indicate that a woman with this name may have survived assassination attempts involving sinking ships and a collapsing ceiling before requesting her eventual killers to strike at her womb. For 10 points, give this Roman female name shared by the mothers of Caligula and Nero.
ANSWER: **Agrippina** <Clarke>

13. The exfoliatin exotoxin released by this genus of bacteria causes pemphigus neonatorum, or SSSS. Clumping factor A is found in a species of this genus that may be identified with the slide test. This genus is divided into CoNS and coagulase-positive species. SCC*mec* elements spread a *mecA* mutation within this genus that encodes PBP2a. The enterotoxin type B produced by a species in this genus can cause toxic shock syndrome. Some strains in it are designated HA- or CA- depending on mode of transmission and can continue synthesizing the cell wall even in the presence of beta-lactams such as methicillin. For 10 points, name this bacterial genus that can cause MRSA with mutated strains of its *aureus* species.
ANSWER: **Staph**ylococcus [or **Staph**ylococcus aureus] <Smart>

14. While trying to put on as many articles of clothing as possible, this novel's protagonist knocks over a can of hairspray, causing the can to fly around the bathroom and break a mirror. This novel's protagonist breaks down crying after spending two hours staring at a photograph of James Clerk Maxwell in a failed attempt to operate the Nefastis machine. A character in this novel, who was once a child movie star named Baby Igor, is the protagonist's co-executor of Pierce Inverarity's will. This novel's protagonist frequently encounters a symbol resembling a muted post horn, which represents an underground mail organization called the Tristero. For 10 points, name this novel about Oedipa Maas, which was written by Thomas Pynchon.
ANSWER: The **Crying of Lot 49** <Golimlim>

15. This author catalogued fifty bad arguments used by politicians in *The Book of Fallacies* and wrote a sarcastic pamphlet about libel juries entitled *The Art of Packing*. An oft-excerpted book by this philosopher advocates expanding the freedom of contract and removing the reliance on tradition in law, and is a response to the legal commentaries of William Blackstone. This man denounced the idea of "relation" as a "fictitious entity" and "community" as a "fictitious body" in his major book, which introduced the "hedonistic calculus." For 10 points, name this author of the *Fragment on Government* whose *Introduction to the Principles of Morals and Legislation* introduced the "greatest happiness principle," causing him to be called the founder of utilitarianism.
ANSWER: Jeremy **Bentham** <Bollinger>

16. A naval officer who opposed this country's independence shot a barrel full of gunpowder after being asked to surrender his ship. This country's first king earlier rejected an offer to become the king of a newly-independent Greece. At the 1830 London Conference, Talleyrand proposed a plan to partition this country. The Ten Days' Campaign failed to quell a revolution in this country, which was sparked by the performance of *The Mute Girl of Portici*. This country, which has been ruled by the House of Saxe-Coburg-Gotha since its independence, must remain neutral according to the terms of the 1839 Treaty of London. For 10 points, name this country whose first king, Leopold I, took power after splitting from the Netherlands.
ANSWER: **Belgium** [or Kingdom of **Belgium**] <Golimlim>

17. A structure in this city contains undecorated empty spaces called "voids," and includes oleasters growing atop very high pillars in its Garden of Exile. A neoclassical factory in this city's Moabit district was created by engineer Karl Bernhard and industrial designer Peter Behrens. A monument in this city, home to the AEG Turbine Factory and a Daniel Liebeskind-designed Jewish Museum, is topped by a quadriga designed by Johann Schadow, and consists of twelve Doric columns, six on each side. Another building in this city was renovated to add a glass dome designed by Norman Foster and, in 1995, was wrapped for two weeks by Jean-Claude and Christo. For 10 points, name this European city, home to the Brandenburg Gate and the Reichstag building.
ANSWER: **Berlin**, Germany <White>

18. A scientist with this surname names the cone-shaped propagation of force produced by a bullet entering glass. Another scientist with this surname is the alphabetically last of two scientists who discovered that electrons colliding with a thin layer of mercury atoms either lost 4.9 electron volts of kinetic energy or no kinetic energy at all. That scientist, Gustav, was the brother of the inventor of the dipole antenna, which was used to show that electromagnetic waves obeyed Maxwell's equations. A scientist with this surname noticed that electrodes sparked more when surrounded by ultraviolet light, discovering the photoelectric effect. For 10 points, give this last name of Heinrich, the scientist who names the SI unit of frequency.
ANSWER: **Hertz** <Golimlim>

19. Alain de Botton claimed that this object induced "appreciation" in a book about how this object's creator can change your life. The effect of this object, "so richly sensual under its severe, religious folds," is compared to Japanese paper that unfolds when placed in water. The episode involving this object concludes the first section of a larger work that begins with the narrator stating, "For a long time, I went to bed early." An object similar to this one was given to the narrator by his aunt Leonie on Sunday mornings. The incident involving this object ends an "Overture" within the "Combray" section of *Swann's Way*. For 10 points, name this object whose consumption triggers the stream of involuntary memory in Proust's *In Search of Lost Time*.
ANSWER: the **madeleine** from *In Search of Lost Time* [prompt on **cake**; prompt on **cookie**] <Sy>

20. In April, this city launched the Indego bike-share network. Losing mayoral primary candidates in this city include a former district attorney known as the "Queen of Death" and a State Senator backed by the pro-charter schools PAC American Cities. Lynne Abraham and Anthony Hardy Williams were defeated in the Democratic primary here by a former councilman and Mummer whose 2013 LGBT equality bill was signed into law by Michael Nutter. Engineer Brandon Bostian claims not to remember a sequence of events here in which his vehicle took a signed 50 mile per hour curve at 106 miles per hour. Jim Kenney is likely to be the next mayor of, for 10 points, what city in which eight people died when Amtrak Train 188 derailed on May 12th?
ANSWER: **Philadelphia**, Pennsylvania <White>

21. In 2000, the British military was horrified to discover that it had paid for the retraining of an infamous sadist from this country, a female militia leader named Adama Cut-Hands. A rebel leader from this country was fond of giving menacing colloquial nicknames to military actions, like "Operation Pay Yourself" and "Operation No Living Thing." This country used IMF funds to pay South African mercenary firm Executive Outcomes to terrorize its citizens. The Abidjan and Lome Accords attempted to end a civil war in this country driven by Foday Sankoh and the Revolutionary United Front, backed by Liberia under Charles Taylor. For 10 points, name this West African country whose rich diamond mines have led to various wars to control Freetown.
ANSWER: **Sierra Leone** <Ray>

1. This phenomenon can be mitigated by land use types with high levels of vegetation as they cool the surrounding area via evapotranspiration. For 10 points each:

[10] Name this phenomenon that results from man-made materials that have low thermal inertia and high emissivities, such as bricks, concrete, and asphalt, storing and releasing heat on a different timescale from natural surroundings.

ANSWER: urban **heat island** effect [or **UHI** effect]

[10] Urban heat islands are best studied from far above and research is thus conducted using techniques from this discipline. This field of study acquires information about the Earth with aircraft and satellites.

ANSWER: **remote sensing**

[10] Some remote sensing satellites make use of this orbit above the Earth's equator, allowing the satellite to appear fixed, in space, to ground observers.

ANSWER: **geostationary** Earth orbit [or **geosynchronous** equatorial orbit; or **GEO**] <Voight>

2. A 1969 paper by Nelson Pike relates these problems to the question of whether God has the ability to sin. For 10 points each:

[10] "Name these theological problems exemplified by "Can God create a stone so heavy He couldn't lift it?"

ANSWER: **omnipotence** paradoxes [accept any answer indicating paradoxes or logical contradictions that would arise for an **omnipotent** or **all-powerful** being]

[10] This Anglican Christian apologist waved away omnipotence paradoxes by claiming that adding "God can" before a phrase cannot turn nonsense into sense. He wrote *Mere Christianity*.

ANSWER: Clive Staples **Lewis**

[10] This Church Father resolved omnipotence paradoxes by claiming that God has power to do everything in His will and all else is irrelevant. He died tending to his bishopric of Hippo during a Vandal siege.

ANSWER: Saint **Augustine** of Hippo [or **Augustinus**] <Jackson>

3. Poseidon and Apollo build one of these structures when Zeus orders them to spend a year working for a human. For 10 points each:
[10] Identify this type of structure, another of which is constructed using stones carried by both Zethus's brute strength and Amphion's enchanting music.
ANSWER: **wall**s [or obvious equivalents; prompt on **fortification**s; prompt on **defense**s]
[10] Zethus and Amphion build the walls of this city founded by Cadmus at the site where a cow lays down. Seven warriors attack this city when Eteocles refuses to give up its kingship.
ANSWER: **Thebes**
[10] This leader of the Seven against Thebes escapes the war with Arion. Later, it is prophesied that the Epigoni cannot take Thebes until the death of this man.
ANSWER: **Adrastus** <Kim>

4. At the beginning of this book, the narrator accidentally causes his house in Natchez, Mississippi to burn down. For 10 points each:
[10] Name this autobiographical book divided into the sections "Southern Night" and "The Horror and the Glory." The narrator of this book works for Olin in Memphis before beginning to write in Chicago.
ANSWER: *Black Boy*
[10] This author of *Black Boy* described Bigger Thomas's errant murder of a white woman named Mary Dalton in *Native Son*.
ANSWER: Richard **Wright** [or Richard Nathaniel **Wright**]
[10] In *Native Son*, this member of the Labor Defenders acts as Bigger's lawyer at his trial. This character challenges the state attorney Buckley by claiming that Bigger's crime was prompted by white power.
ANSWER: **Boris** A. Max [or Boris A. **Max**] <Sy>

5. During this campaign, American forces frequently used "Wild Weasel" hunter/killer teams. For 10 points each:
[10] Name this sustained aerial bombardment campaign that ran from 1965 to 1968 against Communist North Vietnam. While unsuccessful, it was the most sustained aerial campaign for the U.S. Air Force since World War II.
ANSWER: Operation **Rolling Thunder**
[10] The United States entered the Vietnam War after a 1964 incident in which the USS Maddox and Turner Joy were attacked in what body of water?
ANSWER: Gulf of **Tonkin**
[10] This Pulitzer winning work of history by Neil Sheehan profiled retired Lieutenant Colonel John Paul Vann and criticized American policies during the Vietnam War.
ANSWER: A *Bright Shining Lie*: *John Paul Vann and America in Vietnam* <Cheyne>

6. For 10 points each, answer the following about the Spanish Inquisition.
[10] The Spanish Inquisition began in this kingdom ruled by Queen Isabella I. This kingdom absorbed the Kingdom of León and later joined with Aragon through dynastic union.
ANSWER: **Castile**
[10] Participants in these events during the Inquisition were taken to a quemadero. These events resulted in many condemned persons being burnt alive.
ANSWER: **auto-da-fé** [or **auto-de-fé**]
[10] The Inquisition targeted many members of this Spanish ethnic group. They launched a failed rebellion in 1569 and maintained their culture by producing aljamiados in secret.
ANSWER: **moriscos** <Clarke>

7. This instrument joins the violin in the trio sonata that ends *The Musical Offering*, most likely because it was played by Frederick the Great. For 10 points each:
[10] Name this instrument for which J.S. Bach wrote an A minor partita. It was later mastered by the twentieth-century virtuoso Jean-Pierre Rampal.
ANSWER: **flute**
[10] The flute joins the violin and the harpsichord in the concertino group of the fifth piece in this J.S. Bach set of concertos written for a German margrave.
ANSWER: ***Brandenburg*** *Concertos* [or ***Six Concerts à plusieurs instruments***]
[10] This composer wrote a seven-movement Suite in A minor for Flute and Strings. His *Tafelmusik* comprises three suites of six pieces each, scored for increasingly smaller ensembles.
ANSWER: Georg Philipp **Telemann** <Kim>

8. In 1931, Harry Beck introduced a re-design of this system's map, which sacrificed geographical accuracy for clarity and only displayed 90 and 45 degree angles. For 10 points each:
[10] Name this subway system whose Circle Line was changed in 2009 so that it no longer runs in a continuous loop. In 1969, it began warning passengers to "mind the gap."
ANSWER: London **Underground** [or the **Tube**; prompt on descriptive answers mentioning **London**]
[10] This automated light rail system, represented with hollow teal lines on the Underground map, was opened in 1987 to serve its namesake redeveloped industrial area.
ANSWER: **Docklands Light Railway** [or **DLR**]
[10] Another iconic schematic subway map was a 1972 redesign of New York's system by this Italian graphic designer who died in 2014.
ANSWER: Massimo **Vignelli** <White>

9. In the 1890s, a two-volume edition of these works was prepared and edited by Mabel Loomis Todd, who earlier helped Thomas Wentworth Higginson edit the author's poetry. For 10 points each:
[10] Name these works, one of which declares, "If fame belonged to me, I could not escape her," and concludes by asking, "But, will you be my preceptor, Mr. Higginson?"
ANSWER: **letters** of Emily **Dickinson**
[10] When asked by Higginson, Dickinson claimed not to have read this poet's collection *Leaves of Grass*, adding that she "was told that it was disgraceful."
ANSWER: Walt **Whitman**
[10] In a poem, Dickinson criticized the actions of this character as those of a boy "deal[ing] with lesser Boy – to prove ability." She mocked this character by comparing him to Miles Standish in a poem that begins by calling him "a distant – stately Lover."
ANSWER: **God** <Casalaspi>

10. Identify the following concepts related to the Banach-Tarski paradox, for 10 points each.
[10] The Banach-Tarski paradox considers breaking down one of these solid objects and reassembling it into two copies of itself. They consist of all points within a fixed distance from a center point.
ANSWER: **ball**s [or **sphere**s]
[10] Raphael Robinson showed that the sphere must be broken into at least this many pieces. Polynomials of this degree or higher have no general algebraic solution.
ANSWER: **five**
[10] The Banach-Tarski paradox arises from the difficulty of assigning one of these countably additive values, intuitively understood as a "size," to sets in three-dimensional space. The one named for Lebesgue is used to define the Lebesgue integral.
ANSWER: **measure** <Eltinge>

11. This novel introduces Professor Uzzi-Tuzii, the only remaining expert on Cimmerian literature. For 10 points each:
[10] Name this novel whose protagonist, "you, the reader," finds out that both he and Ludmilla bought defective copies of a new novel.
ANSWER: *If on a winter's night a traveler* [or *Se una notte d'inverno un viaggiatore*]
[10] This Italian author of *If on a winter's night a traveler* included conversations between Marco Polo and Kublai Khan about the title places in *Invisible Cities*.
ANSWER: Italo **Calvino**
[10] In Calvino's *The Castle of Crossed Destinies*, the mute protagonists recount tales using these objects. In *The Waste Land*, Madame Sosostris owns some of them.
ANSWER: **tarot card**s [prompt on **card**s] <Golimlim>

12. According to this poet's sister, her last poem is the one beginning "No coward soul is mine." For 10 points each:

[10] "Name this author of "The Visionary" and "The Prisoner." A poem by her sometimes titled "Remembrance" mourns someone who is "cold in the earth--and the deep snow piled above."

ANSWER: **E**mily **Bronte** [or **E**llis **Bell**; prompt on **Bronte**; prompt on **Bell**]

[10] Emily Bronte also wrote this novel about the tragic love between Catherine and Heathcliff.

ANSWER: *__Wuthering Heights__*

[10] In *Wuthering Heights*, Catherine gives a speech saying that she "broke her heart with weeping" to leave this place and come back to earth. In "To the Virgins, to Make Much of Time," the sun is called the "glorious lamp" of this place.

ANSWER: **heaven** <Sy>

13. The political impetus behind this document was the charge of high treason on Bernard Saisset. For 10 points each:

[10] Name this papal bull issued by Boniface VIII, which declared the superiority of spiritual power over secular power.

ANSWER: *__Unam Sanctum__*

[10] The issue of *Unam Sanctum* was part of a feud between Boniface VIII and Philip the Fair, then the king of this country. Philip belonged to its Capetian dynasty.

ANSWER: **France**

[10] Ultimately, Philip the Fair would win the battle against the papacy when he persuaded Pope Clement V to move to this city from Rome, where it stayed for nearly a century until the Great Schism was resolved.

ANSWER: **Avignon** <Lee>

14. Answer the following about digital signal processing, for 10 points each.

[10] To actually do any DSP, one needs a digital signal, which anyone, even Chris Ray, can obtain from an analog signal using this procedure. An analog signal can only be perfectly reconstructed if the rate for this process satisfies the Nyquist criterion.

ANSWER: **sampling** [or word forms; do not accept "discretizing" or other wrong answers]

[10] After obtaining a digital signal, anyone, even Chris Ray, can transform it from the time domain to this domain using a discrete Fourier transform. It is named for a physical quantity with units equal to inverse-seconds.

ANSWER: **frequency** domain

[10] In order to perfectly reconstruct a sampled signal, it must be band-limited. Anyone, even Chris Ray, could use a simple filter of this type to eliminate only high-frequency components and create a band-limited signal. RC circuits are bad, but common, analog examples of these filters.

ANSWER: **low-pass** filters [or **LPF**s; prompt on **high-cut** filter or **treble cut** filter] <Silverman>

15. This man tells a woman that "we all go a little mad sometimes." For 10 points each:
[10] Name this film character who also tells Marion Crane that a "boy's best friend is his mother." He enjoys stuffing birds and suffers from a split personality that appears whenever he is sexually attracted to women, prompting him to become violent, such as when he murders Marion in the shower of her room in his motel.
ANSWER: **Norman** Bates [or Norman **Bates**]
[10] Norman Bates is a major character in *Psycho,* a film by this director of such suspense thrillers as *Rear Window.*
ANSWER: Alfred **Hitchcock** [or Sir Alfred Joseph **Hitchcock**]
[10] Slavoj Zizek draws a parallel between the three floors of Bates's mansion to the superego, ego, and id in this 2006 documentary in which he psychoanalyzes numerous films.
ANSWER: The ***Pervert's Guide to the Cinema*** <Cheyne>

16. This man explained his views on the mental content underlying verbal propositions in his short paper on *Gedanke,* or "the Thought." For 10 points each:
[10] "Name this 19th-century philosopher and mathematician. He noted that "the morning star" and "the evening star" actually refer to the same object despite their differing "cognitive value" in his paper "Sense and Reference."
ANSWER: Gottlob **Frege**
[10] Frege's work on logic moved beyond these basic three-part arguments, in which a major premise and a minor premise lead to a deductive conclusion. They were the basis of Aristotle's logic and of most Western logic instruction for 2300 years thereafter.
ANSWER: **syllogism**s [or **syllogistic** logic]
[10] Instead, Frege's logic largely uses these properties, which can be evaluated as true or false when applied to a variable. The idea of "is tall" in the sentence "John is tall" is one of these, which are usually symbolized by a capital letter preceding a variable in parentheses.
ANSWER: **predicate**s [or **predicate** logic] <Jackson>

17. The *Chicago Tribune* compared this man to Rasputin. For 10 points each:
[10] Name this adviser to Franklin Roosevelt. Besides being a diplomatic troubleshooter, he helped lead the Works Progress Administration and was Secretary of Commerce from late 1938 to 1940.
ANSWER: Henry **Hopkins**
[10] Hopkins helped dictate this World War II policy in which the United States supplied the Allied powers with food and materials. It began on March 11, 1941, and was compared by FDR to a neighbor borrowing a garden hose.
ANSWER: **Lend-Lease**
[10] Hopkins attended this 1943 conference in Asia, the first of the World War II "Big Three" conferences. Held at a Soviet embassy, it featured the Western powers promising to open a second front against Germany.
ANSWER: **Tehran** Conference [prompt on **Eureka**] <Cheyne>

18. A red herring prospectus, as part of a company's IPO, is filed in this agency's EDGAR system. For 10 points each:
[10] Name this US agency that enforces rules regulating markets, secondary trading, and its namesake financial assets, unlike the Federal Trade Commission.
ANSWER: **Securities and Exchange Commission** [or **SEC**]
[10] Google's IPO listed its shares using this type of auction in which the initial price is progressively lowered until a bidder offers to buy. The Aalsmeer Flower Auction uses this auction method that was popularized during a 17-century tulip boom.
ANSWER: **Dutch** auction
[10] In this truthful single-item sealed-bid auction mechanism, the highest bidder wins the item but pays the second-highest bid. It can be generalized for multiple items in a method named after its namesake, Clarke, and Groves.
ANSWER: **Vickrey** auction <Smart>

19. Bergmeister's papilla is a remnant of this vessel ensheathed by Cloquet's canal that extends from the optic disc. For 10 points each:
[10] Name this artery nourishing the lens during embryological development that normally regresses by the second trimester.
ANSWER: **hyaloid** artery
[10] This vestigial structure is at the base of the spine of humans during early development, and a remnant of it present after birth is called the coccyx.
ANSWER: **tail**
[10] In females, the epoophoron is a remnant of the Wolffian duct homologous to this coiled tube found in males that connects the efferent ducts to the vas deferens. Sperm are stored in this structure before ejaculation.
ANSWER: **epididymis** <Smart>

20. In the second painting in this series, a boy raises his hand towards a heavenly castle while standing in a boat that has an hourglass attached to it. For 10 points each:
[10] Name this series of allegorical paintings in which a man's guardian angel leads him on eternal boat ride as he grows older.
ANSWER: The *Voyage of Life*
[10] *The Voyage of Life* is by this American artist from the Hudson River School. He painted the aftermath of a thunderstorm rolling over an oxbow river in Massachusetts.
ANSWER: Thomas **Cole**
[10] Cole created a second set of *The Voyage of Life* for this museum, whose formidable American collection includes Edward Hicks's *The Peaceable Kingdom*, Winslow Homer's *Breezing Up*, and John Singleton Copley's *Watson and the Shark*.
ANSWER: **National Gallery** of Art <Saric>

21. This theorem, when applied to mass, can be used to derive mass continuity. For 10 points each:

[10] Name this specific case of Stokes's theorem, which states that the volume integral of the namesake operation applied to a function F equals the surface integral of F over the boundary.

ANSWER: **divergence** theorem [or **Gauss**'s theorem; or the **Gauss-Ostrogradsky** theorem]

[10] The surface integral over the boundary contains the dot product of F with this vector along the surface. This unit vector is always oriented perpendicularly, outward from the surface.

ANSWER: unit **normal** [or **n**]

[10] Green's theorem transforms the divergence theorem to 2D and can be used to show that the line integral of one-half, times x dy minus y dx, around a 2D region, simply equals this value.

ANSWER: the **area** of the region <Silverman>