

VAULT (Virginia and Upper Illinois Tournament)

Edited by: Jacob O'Rourke, Jamie Burchett, Cavan Gabaldon O'Neill, Akshar Goyal, Soren Gjesfeld, Neal Joshi, Teigue Kelly, and Rohan Kher

Written by: the editors, Hariharan Anathakrishnan, Phoenix Do, Alex Engel, James Fishman, Andrew Huang, Samuel Li, Ethan Ma, Vikram Narasimhan, Salil Pakti, Henry Pan, Akshath Sivachidhambaram, Jeffrey Xu, Mira Zatzenbloom and Caden Zhang

Packet 2 "0 negs i see you"

Questions

1. In 1972, Richard Karp used a many-one reduction to relate 21 tasks based on this characteristic by the Cook-Levin theorem, all of which can be reduced to solving the 3-SAT. Amortized analysis introduces "potentials" to classify this characteristic for insertion and root deletion on a fibonacci heap. A famous (*) computation problem determines whether two types of these characteristics are inherently different. The Karatsuba ("kar-at-soo-bah") algorithm significantly decreases this characteristic for integer multiplications, while Shor's algorithm utilizes QFT to significantly decrease this benchmark for prime factorizations. For 10 points, name these quantifiers of programs commonly denoted using big-O notation.

ANSWER: program runtime [accept time complexity; prompt on time]

<Math - CS, Ma>

1. The author of this algorithm encouraged remembering it with a "mnemonic doggerel" that synthesizes "the whole fabric of morals and legislation."

For 10 points each:

[10h] Name this algorithm that considers 12 pains and 14 pleasures. This algorithm considers the sum of seven vectors like propinquity, purity, and fecundity on the population.

ANSWER: felicific calculus ("fel-ih-SIF-ik calculus") [accept utility calculus, hedonistic calculus, or hedonic calculus]

[10m] Felicific calculus was created by this author of *An Introduction to the Principles of Morals and Legislation*, who also proposed the one-guard Panopticon prison.

ANSWER: Jeremy Bentham

[10e] Jeremy Bentham was a philosopher from this school of thought. J.S. Mill wrote a book titled for this consequentialist system of ethics. This philosophy is often defined as seeking "the greatest happiness for the greatest number."

ANSWER: utilitarianism

<Philosophy, Narasimhan>

2. In a play by this author, a character expresses his disappointment that another man's parakeets don't "carry disease." That play by this author is often performed with its prequel, *Homelife*. This author created the Pritzker prize-winning Martin Gray, who has an affair with the title farm animal. This author of (*) *The Goat, or Who is Sylvia?* wrote a one-act play culminating in Jerry impaling himself on a knife. In a play by this author, Geroge and Martha play games such as "Get the Guests" as they host the young couple Nick and Honey. For 10 points, name this playwright of *The Zoo Story* and *Who's Afraid of Virginia Woolf?*

ANSWER: Edward Albee [or Edward Franklin Albee III]

<American Literature - Drama, Pan>

2. After an assassination attempt, King Sejo dismantled this institution. For 10 points each:
[10h] Name this institution whose *yangban* ("yong-bahn") scholars largely focused on compiling the Hunminjeongeum ("hoon-meen-chong-um"), a treatise on the Hangul writing system.

ANSWER: the Hall of Worthies [accept Jiphyeonjeon]

[10m] Sejong the Great created the Hall of Worthies under this dynasty. Under Admiral Yi-Sun-Sin ("ee soon-shin"), this dynasty successfully resisted Japanese invasions during the Imjin War.

ANSWER: Joseon ("JOH-sun") Dynasty [or Choson dynasty]

[10e] To study at the Hall of Worthies, people seeking to become part of the *yangban* class had to participate in one of these events known as the *Gwageo* ("GWAH-guh"). Chinese versions of these events ensured that members of the government were knowledgeable in Confucianism.

ANSWER: imperial examinations [accept Civil Service exams; or kējū; accept tests in place of "exams"]

<World History, Narasimhan>

3. For demonstrating expansion of the universe using a type of supernova that always involves these objects, Riess, Schmidt, and Perlmutter won a 2011 Nobel Prize. Novas occur when these objects accrete matter. These objects will theoretically turn into a new "black" object at timescales larger than the current age of the universe. Carbon detonation occurs when these objects accumulate matter in a binary system, triggering (*) type 1a supernovae. These objects are at the bottom left of H-R diagrams. Red giants turn into black holes, neutron stars, or these objects. For 10 points, the Sun will eventually become what kind of stellar remnant?

ANSWER: white dwarf stars [or white dwarves; prompt on dwarf stars or dwarves]

<Other Science - Astronomy, Kher>

3. Shurochka ("SHOO-roh-ch-kuh") manufactures one of these events to help Nikolaev further his military career in an Aleksandr Kuprin novel. For 10 points each:

[10m] Name this type of event. Lensky stays up to read Goethe ("GER-tuh") and Schiller the night before one of these events, after which another character temporarily quits society.

ANSWER: duels [prompt on death or equivalents by asking "What caused the death?"] (The Aleksandr Kuprin novel is *The Duel*)

[10e] Like Lensky, this author of *Eugene Onegin* ("oh-NAY-gin") met an untimely end, dying in a duel with Georges d'Anthès ("ZHORZH dahn-TEZ") at a young age.

ANSWER: Alexander Pushkin [or Alexander Sergeyevich Pushkin]

[10h] In this novel, Grushnitsky is advised to "say a prayer before you die" before being shot off a cliff. This Mikhail Lermontov novel's apathetic protagonist Pechorin is named after a northerly river, much like Eugene Onegin.

ANSWER: A Hero of Our Time [or Gerój nášego vrémeni]

<European Literature - Poetry, Pan + Kelly>

4. Objects belonging to this god were buried on the side of a mountain, after which they grew into flowers. The world is currently in an era named for a depiction of this god, according to Aleister Crowley's ("AL-uh-stir KROH-lee") religion Thelema ("thuh-LEMMA"). That depiction of this god as a child with his finger to his lips led the Romans to interpret him as a god of silence named (*) Harpocrates ("har-POCK-ruh-teez"). This god painted a wooden boat gray to deceive his opponent in order to win a race. The wadjet ("WAH-jet") symbol represented this god's eyes, which were restored with milk after being gouged by his uncle, Set. For 10 points, name this falcon-headed sky god, the son of Isis and Osiris.

ANSWER: Horus [accept Harpocrates before read; accept Heru]

<Mythology, Egyptian - Ananthakrishnan>

4. Cell bodies are stored within this structure's dorsal and ventral horn. For 10 points each:

[10e] Name this structure that makes up the central nervous system along with the brain.

ANSWER: spinal cord

[10h] These neural pathways, which control automatic responses, involve a signal being communicated from the spinal cord straight to motor neurons while bypassing the need to reach the brain.

ANSWER: reflex arcs

[10m] Both the spinal cord and brain are enclosed by this set of three membrane layers including the dura and pia mater. Fever and neck stiffness are classical symptoms of inflammation to these layers.

ANSWER: meninges [accept meningitis]

<Biology - Anatomy and Physiology, Kher>

5. In this city, Dinocrates designed a causeway known as the *Heptastadion*. The Letter of Aristeas claims that Demetrius of Phalerum founded an institution in this city later led by Apollonius of Rhodes. While working in this city, Eratosthenes ("air-uh-TOSS-thuh-neeZ") used obelisks to calculate the circumference of the earth. This city's large Jewish population helped construct a 400 foot tall (*) "Pharos." Euclid proposed his Five Postulates while working in this city. Arsinoe IV (ar-SIN-aw-ee "the 4th") was captured during a siege of this city led by Cleopatra and Julius Caesar. Alexander the Great founded, for 10 points, what Egyptian city with a namesake library and lighthouse?

ANSWER: **Alexandria**

<Other History - Ancient, Narasimhan>

5. A woman with this first name who was born without arms became one of the first known artists to paint with their mouth. For 10 points each:

[10m] Give this first name of that 19th century painter with the surname Biffin. An actress with this first name and the surname Siddons is enthroned in front of personifications of Pity and Terror in a depiction of her as the "Tragic Muse."

ANSWER: **Sarah** [or **Sarah** Biffin or **Sarah** Siddons]

[10e] *Sarah Siddons as the Tragic Muse* was painted by this artist, the founder and first president of the Royal Academy. This artist's work *The Brown Boy* was often contrasted with his rival Thomas Gainsborough's *The Blue Boy*.

ANSWER: Sir Joshua **Reynolds**

[10h] Despite the amount of precision it required, most of Sarah Biffin's artistic output falls within this genre. Nicholas Hilliard was a Tudor-era master of this genre which traditionally adorned illuminated manuscripts.

ANSWER: portrait **miniatures** [accept **limnings**; prompt on **portraits**]

<Visual Fine Arts - Painting, Burchett>

6. A lengthy account of this ruler's wife was written by Henry III of Castile's emissary, Ruy Gonz les de Clavijo. Sharaf al-Din Ali Yazdi's *Zafarnama* chronicles this ruler's defeat of the Tughlaq dynasty. A catalog of stars named the *Zij-i-Sultani* was created by this ruler's grandson for his namesake (*) observatory. This ruler's victory at the battle of the Terek River led to the dissolution of the Golden Horde. This ruler captured Ottoman Sultan Bayezid ("BYE-uh-zeed") the Thunderbolt before allegedly constructing a giant pyramid made of skulls. For 10 points, name this ruler of Samarkand who was known for having a limp.

ANSWER: **Timur** [or **Tamerlane**; or **Tamburlaine**; or **Timur**-i-lang; or **Timur** the Lame]

<World History, Narasimhan>

6. Answer the following about twins from Greek mythology. For 10 points each:

[10e] *Two answers required.* Because Hera cursed Leto not to be able to give birth on anchored ground, Leto had to deliver these twin Greek deities of music and hunting on the floating island of Delos.

ANSWER: Apollo and Artemis

[10m] *Two answers required.* These sons of Leda married the Leucippides after killing their cousins Lynceus and Idas. One of these twins gave up half his immortality so that his brother could live.

ANSWER: Castor and Pollux [accept the Dioscuri]

[10h] Castor and Pollux sailed on the Argo with the twins Zetes (“zeet-eez”) and Calaïs, (“cah-lie-iss”) who were the sons of this wind god.

ANSWER: Boreas

<Mythology, Pan>

7. A melodramatic outburst by the protagonist of this novel causes an old man to clock him as “the poisonous young swine who ruined the books on Crystallography.” In this novel, the driver Rex reads a book as two millicents beat a character on the side of the road. The narrator of this novel stumbles upon a building labeled (*) “HOME.” That narrator of this novel jumps out of a window after F. Alexander tortures him with a recording of an Otto Skadelig symphony. For 10 points, the Ludovico Technique forcibly pacifies Alex in what dystopian Anthony Burgess novel?

ANSWER: A Clockwork Orange

<British Literature, Ananthakrishnan + Kelly>

7. Answer the following about the Espionage Front during the American Revolution, For 10 points each:

[10m] This American spy who was hanged in New York after stating “I only regret, that I have but one life to lose for my country”

ANSWER: Nathan Hale

[10e] British spy John André conspired with Benedict Arnold, to sell this military base in New York. This oldest United States military academy sits on the Hudson River.

ANSWER: West Point

[10h] A possibly fictitious woman working for this organization named Agent 355 may have helped foil Andre’s plot. Hercules Mulligan was an agent of this spy ring led by Abraham Woodhull and Robert Townsend.

ANSWER: Culper Ring

<American History, Zatzbloom>

8. Repeatedly undergoing this practice was advocated by the Elcesaites ("el-KEZ-ay-ites") as a cure for rabies. Jesus advocates for performing this practice upon "people of all nations" in Matthew 28. Ulrich Zwingli argued that this practice was mostly symbolic, informed by 16th century theological splits over it which led to the development of the (*) Mennonites and the Amish, who believe this practice is meaningless if performed by those who do not understand it. The US's largest Protestant denomination is an evangelical "Southern" church named for this practice. For 10 points, what ritual inducts someone into Christianity by blessing them with water?

ANSWER: baptism [accept Southern Baptist]

<Religion, Christianity – Burchett>

8. *Description acceptable.* Along with avoiding a 345 million dollar supermax contract, the cause of this event was speculated to be the fact that one of the players involved was "poorly conditioned." For 10 points each:

[10m] Name this event that occurred when a Dallas Mavericks guard was traded for a Lakers center. This trade was the first to swap two reigning All-NBA players for each other midseason.

ANSWER: the Luka Dončić–Anthony Davis trade [accept answers involving the trading of Luka Dončić and Anthony Davis; prompt on answers that mention only one of the two players]

[10e] The Luka Dončić–Anthony Davis trade was a three team trade between Dallas, LA, and this other team, which plays home games in Salt Lake City.

ANSWER: Utah Jazz [accept either underlined portion]

[10h] This Mavericks GM was the main perpetrator of the Luka Dončić–Anthony Davis trade. His "defense wins championships" rationale for the trade has not been received well among fans, who have called for his firing.

ANSWER: Nico Harrison [or Nico Tyrone Harrison]

<Trash, Sports – Pan>

9. These organelles are the target transport destination of firefly luciferase, along with proteins containing a serine-lysine-leucine "targeting sequence." In young plants, a specialized form of these organelles performs a variation of the Krebs cycle called the glyoxylate cycle. Rather than in the mitochondria, very long chain fatty acids undergo beta-oxidation in these organelles. Mutations to PEX genes result in dysfunction of these organelles in Refsum disease and (*) Zellweger syndrome. These organelles prevent reactive oxygen species from damaging cells with the enzyme catalase. For 10 points, name these organelles which break down H₂O₂.

ANSWER: peroxisomes

<Biology – Cell/Molecular, Zhang>

9. In 2006, Bertolt Brecht's *Mother Courage and her Children* was translated into English by this author for a New York City production starring Meryl Streep. For 10 points each:

[10h] Name this American playwright. In one play by this author, the valium-addicted Mrs. Harper hallucinates being with Mr. Lies in Antarctica.

ANSWER: Tony **Kushner** [or Anthony Robert **Kushner**]

[10m] Mrs. Harper appears in this Kushner play subtitled "A Gay Fantasia on National Themes," in which the title beings give Prior Walter the "Anti-Migratory Epistle".

ANSWER: ***Angels In America: A Gay Fantasia on National Themes***

[10e] *Angels in America* is set amidst the 1980s epidemic of this disease. In the play, Roy Cohn discovers that he has this sexually transmitted disease but claims that he has liver cancer to hide his homosexuality.

ANSWER: **AIDS** [or **acquired immunodeficiency syndrome**; accept **HIV** or **human immunodeficiency virus**]

<American Literature - Drama, Pan>

10. This photographer's works were first popularized after he won a competition with a picture of giggling Italian children in *The Last Joke, Bellagio*. This man created an American counterpart to The Linked Ring movement by starting the pictorialist Photo-Secession club. 9 years' worth of cloud pictures comprise this photographer's *Equivalents* series. Seven years after creating his journal (*) *Camera Work*, this photographer founded a namesake gallery at 291 Fifth Avenue. This man photographed lower-class passengers on the SS *Kaiser Wilhelm II* in *The Steerage*. For 10 points, name this photographer, the husband of Georgia O'Keeffe.

ANSWER: Alfred **Stieglitz**

<Visual Fine Arts - Photography, Narasimhan>

10. Answer the following about sanitation innovations in the 19th century, for 10 points each:

[10e] This "Lady with the Lamp" who worked in an overcrowded hospital in Scutari pioneered the use of Polar Area diagrams in sanitation during the Crimean War.

ANSWER: Florence **Nightingale**

[10h] This Hungarian obstetrician reformed general hospital sanitation after implementing the novel process of hand-washing in maternity wards.

ANSWER: Ignaz **Semmelweis** ("*IGG-nahts ZEM-uhl-vice*")

[10m] Joseph Lister applied Louis Pasteur's research to pioneer this aromatic compound's use as one of the earliest antiseptics. This compound consists of a hydroxyl added to benzene.

ANSWER: **phenol** [accept **carbolic acid** or **benzenol** or **phenolic acid**]

<Other Science - Public Health, Fishman>

11. Stanley Coren developed an intelligence test for these animals based on agility and problem-solving. Guy Holmes wrote a book attacking the use of inescapable yoked pairs in an experiment involving these animals. In a study on the gastric system of these animals, food was inserted directly into their stomachs. The use of a (*) shuttle box in a Martin Seligman experiment helped study “learned helplessness” by shocking these animals. Whistles, metronomes, tuning forks, and bells were used on these animals in a 1901 study. For 10 points, name these animals that were classically conditioned by Ivan Pavlov.

ANSWER: dogs

<Social Science - Psychology, Narasimhan>

11. Baeyer’s reagent contains potassium and this anion. For 10 points each:

[10m] Name this polyatomic ion that consists of four oxygen atoms around a +7 oxidation state metal atom.

ANSWER: permanganate [prompt on MnO₄⁻] (“M N O 4 minus”)

[10h] Baeyer’s test is used to detect instances of these *two* types of interactions between carbon atoms. These two interactions have one degree of unsaturation and two degrees of unsaturation, respectively.

ANSWER: double bonds and triple bonds [accept equivalents; do NOT accept out of order]

[10e] Potassium permanganate is a powerful oxidizing agent, meaning it removes these subatomic particles from other species.

ANSWER: electrons [or e⁻]

<Chemistry - Inorganic, Zhang>

12. The derivative of the canonical version of this quantity is equivalent to the partial derivative of the Lagrangian with respect to generalized velocity. This quantity is equal to the energy over the speed of light for massless objects. The Fourier transform of position is equal to this quantity, indicating that (*) position's conjugate variable is this quantity. A case of Noether’s (“*NUH-ter’s*”) Theorem, this quantity’s conservation law corresponds to translational invariance. The time derivative of this quantity is equal to the force in Newton's second law of motion, and the change in this quantity is equal to the impulse. For 10 points, which quantity, conserved in inelastic collisions, is equal to mass times velocity?

ANSWER: linear momentum

<Physics - Mechanics, Sivachidhambaram>

12. This artist's book *Grapefruit* collected a series of "event scores" that instructed readers on how to create her artworks. For 10 points each:

[10m] Name this Japanese artist who encouraged viewers to remove her dress with scissors in her work *Cut Piece*. A sign reading "Hair Peace" was hung behind this artist and her husband in their Amsterdam "bed-in" performance.

ANSWER: Yoko Ono [or Ono Yoko]

[10e] *Cut Piece* is an example of this art form which occurs as "happenings" between artist and audience. The Serbian-American Marina Abramovic is considered the "Grandmother" of this art form.

ANSWER: performance art [prompt on artistic action]

[10h] Ono's *Cut Piece* inspired this 1974 Abramovic work, in which she stood still while audience members were encouraged to do whatever they wished to her with objects ranging from perfume to a loaded gun.

ANSWER: Rhythm 0

<Other Fine Arts – Miscellaneous, Burchett>

13. **In the aftermath of this campaign, the prayer Av Harachamim ("ha-rah-chah-min") was written. En route to this campaign, peasants led by Count Emicho ("EM-ick-oh") slaughtered Jews in the Rhineland Massacres. Godfrey of Bouillon ("bwee-yawn") and his brother Baldwin of Boulogne led the French forces in this conflict. Near the beginning of this broader conflict, (*) Peter the Hermit launched a "People's" version of it. This conflict was kicked off by Alexios Komnenos' ("Kom-nen-os's") appeal for assistance. At the Council of Clermont, Pope Urban II ordered this campaign to a crowd apocryphally cheering *Deus Vult* ("day-uss vult").** For 10 points, name this only successful attempt to recapture the Holy Land by Christian forces.

ANSWER: the First Crusade [prompt on the Crusades; prompt on the Rhineland Massacres and People's Crusade before mention with "what broader campaign was this part of?"]

<European History, Zatzbloom>

13. One of these things at a shrine in Kamakura is white and red instead of the usual Vermillion and Black. For 10 points each:

[10m] Name these gates that mark the entrance to Japanese shrines. These gates bound the sacred space of a temple and the normal space outside of it.

ANSWER: torii

[10e] Torii gates are present at all of this religion's shrines. The Ise ("EE-say") torii are only found at this Japanese religion's Grand Shrine in Honshu.

ANSWER: Shintoism [or kami-no-michi]

[10h] The oldest still-extant Torii gate can be found at a shrine to this Kami in Yamagata Prefecture. Many Samurai used this war kami's *mitsudomoe* emblem as a good luck charm.

ANSWER: Hachiman [accept Yahata; accept Ōjin; accept Tsurugaoka Hachimangū; accept Hachiman-zukuri]

<Religion - Asian non-Hindu, Narasimhan>

14. A resident of this place brings attention to the "penetrating smell like... decomposing bodies" in her house, according to Isabel's "monologue" in this place as she watches the rain. Flowers fall from the sky when this place's founder dies after being tied to a chestnut tree. This place's inhabitants suffer a plague of (*) insomnia started by a dirt-eating orphan. The founder of this place was inspired by dreaming of a "city of mirrors." A windstorm destroys this city after Melquiades's manuscript is decrypted by Aureliano Buendia. For 10 points, name this fictional town, the setting of Gabriel Garcia Marquez's *One Hundred Years of Solitude*.

ANSWER: Macondo

<World Literature - Long Fiction, Pan>

14. Jerzy Franciszek Kulczycki ("YER-zhe fran-SI-seck KOOL-jit-ski") began selling this product after receiving captured ingredients following the 1683 Siege of Vienna. For 10 points each:
[10e] Name this good that was adapted into Melange and Cappuccino forms by 17th century Europeans. This good is typically made after caffeinated beans are brewed into a hot beverage.

ANSWER: coffee

[10h] Abolitionist Luís Gama repeatedly attacked the use of slavery in this Brazilian province's coffee industry. Along with a more northerly state's Belo Horizonte-based dairy industry, this state constituted the "coffee" part of the Brazilian "Coffee with Milk" period.

ANSWER: Sao Paulo

[10m] Ottoman Sultan Murad IV bulldozed coffeehouses to prevent these people from conspiring against him. This military force recruited from the *Devshirme* ("dave-SHEER-may") system was abolished under the Tanzimat reforms.

ANSWER: Janissaries

<Other History - Commodities, Narasimhan>

15. The usage of tinted windows and black granite in this architect's only skyscraper led it to be nicknamed "Black Rock." Florence Knoll collaborated with this architect on a chair with angled armrests resembling a namesake insect and another which was featured on *Star Trek*. This architect's usage of thin concrete shells is exemplified by his design for (*) MIT's Kresge ("KRESS-ghee") Auditorium and a building whose roof resembles an airplane, the TWA Flight Center. This architect used a catenary curve as the basis for his most famous work. For 10 points, name the Finnish architect who designed St. Louis's Gateway Arch.

ANSWER: Eero Saarin

<Other Fine Arts - Architecture, Fishman>

15. Michael Cunningham's novel *The Hours* opens with this author drowning herself in the River Ouse. For 10 points each:

[10e] Name this English author who wrote about Septimus Smith's suicide during Clarissa's party in *Mrs. Dalloway*.

ANSWER: Virginia **Woolf** [or Adeline Virginia **Woolf**; accept Adeline Virginia **Stephen**]

[10h] Woolf also wrote this experimental novel, in which Bernard, Susan, Rhoda, Neville, Jinny and Louis reflect on their mutual friend Percival through a series of monologues.

ANSWER: *The Waves*

[10m] Woolf wrote both *Mrs. Dalloway* and *The Waves* using this narrative style characterized by an uninterrupted flow of the narrator's thoughts, often ignoring punctuation and grammar.

ANSWER: **stream of consciousness**

<British Literature - Long Fiction, Pan>

16. A poem in this language inspired by a religious hymn has sections titled "Genesis," "The Passion," and "The Gloria." One writer produced a 33,333-line poem as a "modern sequel" to an earlier work in this language. Edmund Keeley's translation renders a line of poetry in this language as "if you find her poor, [the title city] won't have fooled you." The speaker of a poem in this language sees "the (*) senators sitting there without legislating" due to the title group, who are "a kind of solution." That poem in this language is "Waiting for the Barbarians." For 10 points, give this language used by poets Constantine Cavafy ("kuh-VAFF-ee") and Nikos Kazantzakis ("kazz-ant-ZACK-iss").

ANSWER: modern **Greek** [or Demotic **Greek**; accept **Elliniká** or **Hellenica**; do not accept or prompt on "ancient Greek"] (The first poem is Odysseus Elytis's "The Axion Esti")

<European Literature - Poetry, Pan>

16. During this conflict, American volunteers formed the "Abraham Lincoln Brigade" to support one side. For 10 points each:

[10e] Name this war, during which Emilio Mola coined the term "fifth column" before dying in a plane crash. The Nazi-backed Nationalists won this war under General Francisco Franco.

ANSWER: the **Spanish Civil War** [accept **Guerra Civil Española**]

[10h] *Description Acceptable*. Germany's pro-Franco airborne Condor Legion performed this action during the conflict. Mola may have ordered this action codenamed Operation Rügen.

ANSWER: bombing of **Guernica** [accept any action indicating the destruction of **Guernica**; prompt on answers generally describing a **bombing**]

[10m] This country's Corps of Volunteer Troops fought alongside Francoist forces in the Battle of the Ebro. This country launched a failing invasion of Greece two years later as part of an imperial project termed *Mare Nostrum*.

ANSWER: Kingdom of **Italy** [or **Italia**]

<European History, Zatzbloom>

17. Activation energy has a quadratic dependence on both reorganization energy and this quantity in Marcus theory. The Nernst equation is derived from the fact that this quantity's magnitude equals the reduction potential times number of electrons times Faraday's constant. The derivative of this thermodynamic potential with respect to (*) particle number gives the chemical potential. This quantity equals minus RT times the natural log of the equilibrium constant, or enthalpy minus the product of temperature and entropy. This quantity's sign determines a reaction's spontaneity. For 10 points, give this quantity symbolized G, named after an American chemist.

ANSWER: Gibbs free energy [or Gibbs Energy; prompt on free energy; prompt on G or delta G]

<Chemistry - Thermodynamics, Kher>

17. Works by composers from this city's "Second" school were performed during the riotous 1913 Skandalkonzert ("scandal-concert"). For 10 points each:

[10e] Name this city where composers like Alban Berg and Arnold Schoenberg pioneered usage of the twelve-tone technique.

ANSWER: Vienna [or Wien; accept Second Viennese School]

[10h] Berg utilized the twelve-tone technique to write this unfinished opera about a woman who falls into prostitution after fleeing to London. In this opera, the titular character and her sister Geschwitz ("GESH-vits") face their demise at the hands of Jack the Ripper.

ANSWER: Lulu

[10m] Berg paused work on *Lulu* in 1935 to compose one of these pieces "dedicated to the memory of an Angel" upon the death of Manon Gropius. Joseph Joachim revived Ludwig van Beethoven's D major piece in this genre that opens with four timpani beats.

ANSWER: violin concertos [or violin concerti; prompt on concertos]

<Auditory Fine Arts - Classical, Narasimhan>

18. To celebrate the 50th anniversary of Amsterdam's Concertgebouw ("consert-GEH-boo"), a composer from this country adapted an Ady Endre ("EN-druh") poem into his *Peacock Variations*. In an opera from this country, a soldier claims he defeated Napoleon's army with a single draw of his sword. That opera begins with what the composer called a "musical sneeze." Another composer from this country used "arch form" in a work whose "Elegia" third movement exemplifies his (*) "night music" style. That composer's 4th string quartet features his namesake "snap" pizzicato. For 10 points, name this home country of Zoltán Kodály ("koh-DIE"). and the composer of a *Concerto for Orchestra*, Béla Bartók.

ANSWER: Hungary [or Magyarország]

<Auditory Fine Arts - Classical, J. Xu>

18. For 10 points each, answer the following about the International Thermonuclear Experimental Reactor, a 20 billion dollar science experiment.

[10m] Instead of using elemental hydrogen, the costly research at ITER aims to fuel nuclear fusion using these two radioactive isotopes of hydrogen.

ANSWER: deuterium and tritium

[10e] The planned fusion reactor takes on this Soviet design that confines the high energy plasma in a torus using external magnetic field lines.

ANSWER: tokamak

[10h] This other plasma confinement design compresses the plasma using a self-generated magnetic field surrounding the plasma flow, but suffers from Sausage and Kink instabilities.

ANSWER: Z-Pinch

<Physics - Quantum/Particle/Relativity, Ma>

19. During a case involving this company, Noel Francisco raised a hypothetical about the kidnapping of Jeff Bezos's children. This company implemented "Project Texas" in an attempt to appease CFIUS ("see-fus"). During a 2024 hearing, Tom Cotton questioned whether this company's CEO lived in (*) Singapore. Jeff Jackson lost 200,000 followers on this platform after voting for a May 2024 divestiture bill. A platform owned by this company shut down and then re-appeared following an executive order issued by Donald Trump. The U.S. Supreme Court ruled that the government could ban, for 10 points, what social media platform?

ANSWER: TikTok [prompt on ByteDance]

<Modern World - Current Events, Narasiman>

19. A travelog by this author opens by remarking "The months and days are the travelers of eternity" and recounts a journey with his companion Sora. For 10 points each:

[10m] Name this Japanese poet who wrote *The Narrow Road to the Deep North*. This poet was famously gifted a banana tree by his disciples, but left it behind after his hut burned down.

ANSWER: Matsuo Bashō [accept either underlined portion; accept Matsuo Kinsaku; accept Matsuo Chūemon Munefusa]

[10e] Bashō's poetry was written in this form of three lines of five, seven, and then five-syllables. Bashō's best-known poem in this form describes a frog jumping into a pond.

ANSWER: haiku [or hokku]

[10h] Haikus often feature these words in their first lines in order to simultaneously separate and connect two independent thoughts about the subject. These words are often followed by a long dash or ellipsis.

ANSWER: kireji [or cutting word]

<World Literature - Poetry, Ananthakrishnan>

20. This man paused a campaign to ensure Ricky Ray Rector was executed. After a previous health insurance proposal was sunk by the "Harry and Louise" ad, this president signed HIPAA. After this president signed tax increases, the "Contract with America" was written by Newt Gingrich. Special Counsel (*) Ken Starr investigated this president's Real Estate purchases in the Whitewater scandal. This president infamously declared that he "did not have sexual relations with that woman" while responding to the Monica Lewinsky scandal. For 10 points, name this president who supported his wife Hillary's later Presidential campaign.

ANSWER: Bill Clinton [accept William Jefferson Clinton]

<American History, Narasimhan>

20. Through branching processes, actin filaments in human cells assemble into these geometric shapes. For 10 points each:

[10e] Benoit Mandelbrot's ("*ben-WAH MAN-del-brot's*") paper "How Long is the Coast of Britain?" introduced the study of these shapes, examples of which include the Menger ("*MENG-er*") sponge and the Sierpinski ("*seer-PIN-skee*") triangle.

ANSWER: fractals

[10m] Felix Hausdorff ("*HOWZ-dorf*") discovered a variety of this quantity which measures a fractal's essential "roughness." For a single point, this quantity is zero, and for a line segment, this quantity is 1.

ANSWER: dimension [accept topological dimension or Hausdorff dimension]

[10h] The namesake of this constant discovered that it arose in dynamical systems that approach chaotic behavior, serving as a "universal constant of chaos theory". This constant determines the intervals at which the "budding" of the Mandelbrot set along the negative real axis occurs.

ANSWER: first Feigenbaum constant ("*FAI-gun-baum*")

<Math, Sivachidhambaram>

21. In a critique of this concept, Mario Bunge ("*BOON-gay*") attacked it as "fuzzy and remote from science." One philosopher introduced the word *Aufhebung* ("*ow-fee-boong*") to describe how this process could be overcome with time. In a work titled "[this concept] of Enlightenment," Max Horkheimer and Theodor Adorno introduced the idea of the (*) "culture industry." While claiming that this concept exists between "masters and slaves," George Hegel rejected Johann Fichte's ("*FICK-tuh's*") scheme for it. This concept was used to analyze class struggle by Karl Marx. For 10 points, name this concept that attempts to create synthesis from thesis and antithesis.

ANSWER: dialectic [accept Dialectic of Enlightenment or dialectical materialism]

<Philosophy, Narasimhan>