Illinois Masonic Academic Bowl
2020 State Tournament

Round 4
1st Section
Toss-up Questions

Question #1: Mathematics

10 points

The countable additivity [“add”-ih-TIV-ih-tee] axiom is about this operation being applied to events and a summation of probabilities. A conjecture about families of sets closed under this operation states that there is an element in at least half of the sets. An algebraic set is called “irreducible” if it cannot be expressed using this operation. If this operation is performed on a set and the set’s complement, then the result is the universal set. If two sets are disjoint, then this operation on them forms a set whose cardinality is the sum of the original sets’ cardinalities. Name this operation on sets whose result is the set of all elements in *either* or *any* of the original sets.	**union**

Question #2: Social Studies

10 points

A short-lived country named for this river was started and ended by Antonio Canales [kuh-NAH-“lace”] in 1840 and led by Jesús de Cárdenas [hay-ZOOSS day KAR-day-nahss]. A shift in the path of this river caused the Chamizal [chah-MEE-zahl] dispute, which led to an assassination attempt against President Taft. The Tiguex [TEE-wish] War took place when Francisco Vázquez de Coronado attacked Native Americans near this river. The United States fought a war over the territory between this river and the Nueces [noo-“ACE-ace”] River. Name this river that, according to the Treaty of Guadalupe Hidalgo [ee-DAHL-goh], forms part of the border between the U.S. and Mexico.	**Rio Grande** (del Norte) [or Río **Bravo** (del Norte)]

Question #3: Literature

10 points

This poet yearns "Oh for boyhood's painless play" in a work about a boy who "hast more than he can buy". This writer began that poem "Blessings on thee, little man." In another poem by this writer, a woman says "Ah me! That I the Judge's bride might be!". In that poem, this person wrote "For of all sad words of tongue or pen, the saddest are these: 'It might have been!"'. Another poem by this writer is about a 90-year-old woman who recovered a Union flag in Frederick, Maryland during the Civil War. Name this poet who wrote "The Barefoot Boy", "Maud Muller", and "Barbara Frietchie".	John Greenleaf **Whittier**

Question #4: Science

10 points

This substance moves through the canals of Hering. A duct named for this substance helps form the ampulla of Vater. Both the production and release of this substance is increased by the hormone cholecystokinin [KOH-luh-SISS-toh-KY-nin]. This substance reduces surface tension by acting as a surfactant, creating micelles ["my-SELLS"] that make lipase ["LIE-pace"] more efficient. Taurocholic [TOR-oh-KOH-lik] acid is in this substance and is a component of its namesake salts. This substance is produced in the liver and stored in the gallbladder. Name this substance that digests fats and which is yellowish-greenish.	**bile** [prompt on **gall**]

Question #5: Miscellaneous

10 points

A very popular textbook about this technology was written by Stuart Russell and Peter Norvig. This technology's name was coined by John McCarthy, who developed the Lisp programming language. Stephen Hawking said that the emergence of this technology could be the "worst event in the history of our civilization". Some people worry that this technology will bring us to a "singularity" at which point humans will lose control of technology. Name this technology in which computers "think" like humans.	**artificial intelligence** or **AI** [or **machine intelligence** or **artificial** general **intelligence** or **AGI**]

Question #6: Social Studies

10 points

This river starts near the town of Cape Vincent, and a widening of this river forms Lake Saint Pierre, which has an archipelago [ark-ih-PEL-uh-goh] with over 100 islands. The water from this river passes by Anticosti [ahn-tee-KOHSS-tee] Island before entering a gulf that shares its name. The Gaspé [gas-pay] Peninsula is the south side of this river's mouth. This river's namesake gulf contains Cape Breton [BREH-tun] Island, Prince Edward Island, and the west side of Newfoundland Island. This river goes through Montreal and Quebec City. Name this river that flows northeast from Lake Ontario, forming part of the border between New York and Canada.	**St. Lawrence** River

Question #7: Literature

10 points per part

The gods and spirits associated with this religion are called *kami* [kah-mee].		
1	Name this Japanese religion some of whose myths were taken from the *Kojiki*.	**Shinto**ism
2	This Shinto goddess, along with her husband Izanagi, created the Japanese islands and many other deities.	**Izanami**
3	This god, who later merged with Ebisu [eh-bee-soo], was the first child of Izanami. This god and Awashima were born deformed, and they were abandoned by their parents.	**Hiruko** [prompt on **Kotoshiro**-nushi-no-kami]

Question #8: Literature

10 points per part

Answer the following about myths involving chariots:		
1	This son of Helios insisted on driving the sun chariot for a day, which did not end well.	**Phaethon** [FAY-uh-thun]
2	Freyja's [FRAY-yuh'z] chariot was pulled by two of these animals, who were gifts from Thor.	(male or tom)**cat**s
3	These mythological animals pull Nemesis's chariot. In Dante's *Divine Comedy*, Beatrice rides in a chariot pulled by these animals.	**griffin**s [or **grype**s]

Question #9: Social Studies

10 points per part

This person famously crossed the Alps with elephants.		
1	Name this leader of Carthage during the Second Punic War.	**Hannibal** (**Barca**) [accept either]
2	The Second Punic War ended when Hannibal lost to Scipio [SKIP-ee-oh] Africanus at this battle in 202 BCE.	Battle of **Zama**
3	After that defeat, Hannibal helped this leader of the Seleucid [suh-LOO-sid] Empire, who eventually was also defeated by the Romans.	**Antiochus** [an-"TIE"-oh-kuss] **III** or **Antiochus the Great** [prompt on **Antiochus**]

Question #10: Social Studies

10 points per part

This African country is in much of the same region that was in Nubia [NOO-bee-uh] and Kush in ancient times.		
1	Name this country whose southern section seceded in 2011. Name the country from before the secession, not the new country.	(Republic of the) **Sudan** or (Jumhuriyyat as-)**Sudan** [do not accept "South Sudan"]
2	After helping to put down the Taiping Rebellion, this Englishman became the governor-general of the Sudan. He was killed by forces supporting a religious figure called the Mahdi.	Charles "Chinese" **Gordon**
3	This Englishman won the Battle of Omdurman in 1898 to gain control of Sudan. After that, this person and Lord Roberts used brutal tactics in the Second Boer War.	Lord Herbert **Kitchener**

Question #11: Science

10 points per part

This type of region is usually not recognized as a biome [BY-ohm], but Robert Bailey classified it as a humid tropical domain.		
1	Give this term for a region that is the home of a very large number of species and gets over 100 inches of precipitation per year.	**rainforest**s
2	Many species live in this dense rainforest layer that is about 100 feet above the ground.	**canopy**
3	These woody vines are rooted in soil and use trees as support to reach up to and across the canopy. These plants are in several different plant families.	**liana**s [**lee-AH-nuh**z] [or **liane**s]

Question #12: Science

10 points per part

The Earth's lithosphere [LITH-uh-"sphere"] contains the upper mantle and this layer.		
1	Name this outermost solid layer of Earth.	**crust**
2	This thin layer, where seismic waves accelerate, is the border between the crust and the mantle.	**Moho** discontinuity [or **Moho**rovičić [moh-hoh-ROH-vich-ich] discontinuity]
3	While much of the Moho discontinuity is in the lithosphere, some of it enters this layer of the upper mantle whose heat allows for tectonic plate movement.	**asthenosphere** [ass-THEE-noh-"sphere"]

Question #13: Fine Arts

10 points per part

This musical is based on poems by T. S. Eliot.		
1	Identify this musical whose characters are all a certain type of animal.	***Cats***
2	The first act of *Cats* ends with an introduction to this song which is performed in full in the second act. This song states "all alone in the moonlight I can dream of the old days."	**"Memory"**
3	This is the name of the cat who is described as The Glamour Cat and who sings "Memory".	**Grizabella** [griz-uh-BELL-uh]

Question #14: Fine Arts

10 points per part

This musical is based on George Bernard Shaw's play *Pygmalion* ["pig-MALE"-ee-un].		
1	Name this musical about a bet between Colonel Pickering and Professor Higgins over whether they can pass off Eliza Doolittle as a woman of high society.	***My Fair Lady***
2	*My Fair Lady* was one of several collaborations between this composer and the lyricist Alan Jay Lerner.	Frederick **Loewe** [loh]
3	In the second act of *My Fair Lady*, Eliza's father Alfred decides to get married and sings this song, including the line "Ding dong! / the bells are gonna chime."	**"Get Me to the Church on Time"**

Question #15: Literature

10 points

One poem by this writer asks "What candles may be held to speed them all?" and ends with the line "each slow dusk a drawing-down of blinds". This poet's rejection of religion can be seen in that poem's line "No mockeries now for them; no prayers nor bells." Another poem by this writer begins "Bent double, like old beggars under sacks". This writer began the second stanza of that poem with the exclamation "Gas! Gas! Quick, boys!". The title of that poem means "It is sweet and glorious" in Latin. Name this English poet who wrote "Anthem for Doomed Youth" and "Dulce et Decorum est" ["DULL"-kay et day-KOR-um est] before he died in World War I.	Wilfred (Edward Salter) **Owen**

Question #16: Science

10 points

A number of efforts to monitor these events have been the Multi-Instrument Aircraft Campaigns, or MACs. These events seem to come from a point called the apparent radiant. The most noticeable of these events take place in mid-August and mid-November each year. These events occur when Earth passes through the path of a comet. The names of these events are usually made by changing the end of the name of a constellation so that it ends in "-id". Name these events, such as the Perseids and Leonids, during which there are bright flashes in the sky.	**meteor shower**s

Question #17: Social Studies

10 points

According to legend, this man and his wife Padmavati [pad-mah-VAH-tee] had a son Kunala [kuh-NAH-lah] who was blinded by this man's other wife Tishyaraksha [tish-yah-RAK-shuh]. The monk Upagupta [oo-pah-GOOP-tah] is credited with overseeing this leader's religious conversion, after which this leader inscribed religious messages on several pillars. The national emblem of India is based on a column this leader erected at Sarnath [sar-nahth] showing four lions. After conquering Kalinga [kuh-LIN-guh], this leader decided to focus on Buddhism rather than war. Name this third-century BCE leader who was the son of Bindusara [bin-doo-SAH-ruh] and grandson of Chandragupta Maurya.	**Ashoka** (the Great) [or **Ashoka** Maurya or Devanampriya Priyadarshi Samrat **Ashoka**]

Question #18: Literature

10 points

In a novel by this writer, a sign at the zoo says "The little monkey that used to live here was blinded because of the senseless cruelty of one of the visitors. An evil man threw tobacco into its eyes." In that novel, this author depicted a patient who loves both the nurse Zoya and the doctor Vera Gangart. In another novel by this author, the protagonist is led by Tyurin and Pavlo, but he is sentenced to three days' penalty with work by The Tartar. This author of *Cancer Ward* drew on his experiences from 1945 to 1953 as a prisoner. Name this Soviet author of *One Day in the Life of Ivan Denisovich* [deh-NEE-soh-vich].	Aleksandr (Isayevich) **Solzhenitsyn** [sohl-zheh-NEET-sin]

Question #19: Science

10 points

One of the rules named for this person states that atoms with high valence and small coordination number do not share edges and faces. Another rule named for this scientist states that crystals have small numbers of shapes; that rule is the rule of parsimony. In addition to five rules on crystal structures, this person developed a scale that uses bond dissociation energies to quantify elements and classify bonds between them. Name this American scientist whose development of an electronegativity scale and opposition to nuclear weapons testing earned him Nobel Prizes in both Chemistry and Peace.	Linus **Pauling**

Question #20: Fine Arts

10 points

A painting by this artist shows a woman helping to support a large basket that is held to a man's back with a large yellow sash. This artist painted that man wearing white and on his hands and knees with a basket full of pink flowers. Another work by this artist contained panels titled *The Frontier of Ethical Evolution* and *The Frontier of Material Development*, and it later became *Man, Controller of the Universe*. That original work was destroyed when this artist refused to remove a portrait of Lenin. Name this creator of *Man at the Crossroads* who often portrayed Mexican history and was married to Frida Kahlo.	Diego **Rivera**

Question #21: Social Studies

10 points per part

This person found that people are more likely to mail lost letters to people or favorable organizations than to stigmatized organizations.		
1	Name this psychologist who also found that people will obey authority figures who tell them to administer shocks to other people.	Stanley **Milgram**
2	In another experiment, Milgram found support for the idea that there is this number of separations between people on average.	**six** degrees of separation
3	Milgram studied under this psychologist who ran an experiment in which a group of people were asked which of three segments was the same length as a given segment. The last person asked was the only actual subject of the experiment; the others were actors.	Solomon **Asch**

Question #22: Social Studies

10 points per part

Anna Freud listed this behavior as the first defense mechanism.		
1	Name this phenomenon in which a person returns to an earlier stage of development, behaving more childishly than they had been.	**regress**ion or **regress**ing
2	Sigmund Freud linked regression to this part of the psyche more than the id or the super·ego.	**ego**
3	Another defense mechanism on Anna Freud's list was this transformation of socially unacceptable impulses to socially acceptable actions.	**sublimation** [or **sublimating**]

Question #23: Mathematics

10 points per part

This type of division can be used when dividing any polynomial by a first-degree polynomial.		
1	Name this type of division that usually is faster than long division.	**synthetic** division
2	Divide the quantity "x squared minus $5x$ minus 14", end quantity, by the quantity "x plus 2".	$\boldsymbol{x - 7}$ [or $\boldsymbol{x + -7}$; accept either of those answers with a 1 before the x]
3	Find the remainder when the quantity "$2x$ cubed plus $4x$ squared plus $3x$ plus 5", end quantity, is divided by the quantity "x minus 2".	**43**

Question #24: Mathematics

10 points per part

These features are often drawn as dashed lines, and are often found in relation to rational functions.		
1	Give this term for a line that a function's graph approaches as a limit.	**asymptote**s
2	Find an equation for the oblique asymptote of the rational function "y equals the quantity $2x$ squared minus $3x$ plus 5, end quantity, all over the quantity x plus 1". Use slope-intercept form.	$\boldsymbol{y = 2x - 5}$ [or $\boldsymbol{y = 2x + -5}$]
3	Find the slope of either asymptote of the hyperbola generated by the equation "x squared over 16, minus y squared over 9, equals 1".	$\boldsymbol{3/4}$ or $\boldsymbol{-3/4}$ [accept $\boldsymbol{\pm 3/4}$; accept $0\boldsymbol{.75}$ or $\boldsymbol{-}0\boldsymbol{.75}$ or $\boldsymbol{\pm}0\boldsymbol{.75}$]

Question #25: Literature

10 points per part

This essay states "So long as you write what you wish to write, that is all that matters; and whether it matters for ages or only for hours, nobody can say."		
1	Name this essay published in 1929 based on two talks on the topic "Women and Fiction".	"A **Room of One's Own**"
2	This author of *To the Lighthouse* wrote "A Room of One's Own".	Virginia (Adeline **Stephen**) **Woolf** [accept either underlined name]
3	The essay states that a woman needs two things to write fiction: a room of her own and what else?	**money** [accept any reasonable answer conveying that idea]

Question #26: Literature

10 points per part

This character says, "We are such stuff as dreams are made on, and our little life is rounded with a sleep."		
1	Name this character who tells Ariel to summon the spirits of Iris, Juno, and Ceres [SEER-eez] to celebrate the engagement of Ferdinand and Miranda.	**Prospero**
2	Prospero appears in this William Shakespeare play named for the storm caused by Ariel.	*The* ***Tempest***
3	This poet used a series of dramatic monologues spoken by characters from *The Tempest* in his poem "The Sea and the Mirror".	W(ystan) H(ugh) **Auden**

Question #27: Science

10 points per part

This is the stage of development in which primitive organs develop.		
1	Name this stage that lasts about seven weeks from the blastula and gastrula to the fetus.	**embryo**nic stage
2	An early embryo has three germ layers. Name the layer that develops into the circulatory system, muscles, and bones.	**mesoderm** [MEZ-oh-durm]
3	The mesoderm signals the ectoderm to form this structure that lasts from about the 19th to 25th day of embryonic development and is opposite the primitive streak.	**neural plate**

Question #28: Science

10 points per part

Neutrophils [NOO-troh-filz] and lymphocytes [LIM-foh-"sites"] are examples of this type of cell.		
1	Name this type of blood cell that has a nucleus.	**white** blood cells [or **leukocyte**s; accept **WBC**s]
2	These lymphocytes can react against cells without prior sensitization, which makes them the best defense against tumor cells.	natural **killer** cells [accept N**K** cells]
3	Natural killer cells and T cells interact with the Class 1 molecules named for this set of genes. In humans, the two molecule classes can be called the human leukocyte antigen.	**major histocompatibility complex** or **MHC**

Question #29: Literature

10 points

At the beginning of one novel by this author, the body of 12-year-old Zhenia Golov [ZHEN-yuh GOH-lawff] is found. That novel, which this author based on the 1913 Beilis [BAY-lees] trial in Russia, is about Yakov Bok. Another novel by this author starts on a train, where the protagonist uses a bassoon case to carry an object he calls "Wonderboy". In that other novel by this author, the protagonist impresses Harriet Bird, who tries to kill him. The way that protagonist impresses Bird is by taking on a challenge by Walter "The Whammer" Whambold and striking him out. Name this Jewish American author of *The Fixer* and *The Natural*.	Bernard **Malamud**

Question #30: Science

10 points

An attempt to discredit this rule, but which instead led to the idea of quantum entanglement, was the Einstein-Podolsky-Rosen paradox. This rule applies when the canonical commutation relation is not zero. A thought experiment designed to support this rule involved a microscope that used a photon to observe an electron. This rule applies to conjugate quantities such as energy and time, or different components of angular momentum. Name this rule which states that the product of the errors in the measurements of position and momentum must be at least a certain constant.	Heisenberg **uncertainty** principle [accept **indeterminacy** principle; prompt on **Heisenberg**]

Question #31: Social Studies

10 points

This person served as the governor of New York for two months before resigning to become U.S. Secretary of State. This person eventually resigned as Secretary of State, after having sided with the Eatons, to help Andrew Jackson re-organize his Cabinet. This person then served as vice president during Jackson's second term. In 1848, this person was the Free Soil Party presidential candidate. When this person was president, there were a series of bank failures during the Panic of 1837. Name this successor of Andrew Jackson who lost his re-election campaign to William Henry Harrison.	Martin **Van Buren**

Question #32: Mathematics

10 points

This operation is performed on the number of trials before using a combination to evaluate a negative binomial distribution. Performing this operation and then taking a factorial is equivalent to applying the Gamma function. This operation is performed on the number of observations in Bessel's correction, which gives the sample standard deviation instead of the population standard deviation. Performing this operation on an exponent has the same effect as dividing the power by the base. In the power rule, this operation is performed on the exponent to find the exponent for the derivative. Name this operation that is performed on the input of a function to shift a graph a unit to the right.	**subtract**ing **1** or **minus 1** [accept **add**ing **negative 1**; prompt on **subtract**ing or **minus** or **lessen**ing or **decrease/ing**]

Extra Question #1: Fine Arts

10 points

Because this German composer's wife was partly Jewish, he moved to the United States in 1940, where he wrote a piece based on three piano duets and some incidental music. This composer wrote an opera about a painter whose work is interrupted by a peasant rebellion led by Hans Schwalb. That opera is *Mathis der Maler*. When King George V of Britain died, this composer spent six hours writing *Trauermusik*, which was performed the next day instead of this composer's *Der Schwanendreher* ["dare" SHVAHN-end-reh-hur]. Name this composer of *Symphonic Metamorphosis of Themes by Carl Maria von Weber* [VAY-bur].	Paul **Hindemith**

Extra Question #2: Science

10 points

The energy stored in a capacitor equals this number times charge times the voltage across the capacitor. The focal length of a concave spherical mirror equals this number times the distance from the mirror to the center of curvature. The potential energy stored in a spring equals this number times the spring constant times the square of displacement. If there is constant acceleration, displacement divided by time equals this number times the sum of the initial and final velocities. Kinetic energy equals this number times mass times speed squared. Name this number between zero and 1.	**1/2** or 0**.5**

Extra Question #3: Literature

10 points

In one book by this writer, an Indian servant named Santosh marries an African-American woman to gain citizenship. That story, "One out of Many", is included with "Tell Me Who to Kill", travel journal excerpts, and a novella set in what seems to be Uganda [pause] in this author's Booker Prize-winning book. In another novel by this writer, the protagonist becomes a sign-painter for the Tulsi family and marries Shama. This author wrote that that protagonist, named Mohun, was born with an extra finger. Name this author of *In a Free State* and *A House for Mr. Biswas* who was born in Trinidad and Tobago.	V(idiadhar) S(urajprasad) ("Vidia") **Naipaul**

Extra Question #4: Social Studies

10 points

One of these texts has 42 very short chapters and was used to spread Buddhism to China. In Jainism, several Agamas are classified as this type of text, including the first one, entitled Acharanga [ah-kah-RAHN-gah]. Jains also recognize the *Cheda* set of these texts, which includes the *Kalpa*. In Hinduism, this term refers to many works full of aphorisms, including Badarayana's works and Patanjali's works describing yoga. In Buddhism, this term refers to works that are attributed to the Buddha and his disciples, such as the *Diamond* and the *Lotus*. Give the name of these texts, including a work on sexuality, which is called the *Kama* one.	**sutra** [or **sutta** or **suya**]

Extra Question #5: Mathematics

10 points

The person whom this concept is named for used it to justify both his theory of types and axiom of reducibility. This concept is used to show why the comprehension axiom should be restricted in set theory, leading to changes in theories put forth by Gottlob Frege [FRAY-guh]. The axiom of separation was used by Ernst Zermelo to develop a set theory that was not plagued by this idea. Identify this paradox concerning "the set of all sets that are not members of themselves", and which is named for the person who wrote *Principia Mathematica* with Alfred North Whitehead.	**Russell**'s **paradox** [accept just **Russell**'s after "paradox"; accept **Russell**'s **antinomy**; prompt on the set of **all sets that are not members of themselves** before "all sets"]

Extra Question #6: Literature

10 points per part

In this novel, Booker T. Washington tries to intervene when Coalhouse Walker takes over J. P. Morgan's library.		
1	Identify this novel named for the type of music that Coalhouse Walker performs.	***Ragtime***
2	*Ragtime* was written by this author of *Billy Bathgate*.	E(dgar) L(awrence) **Doctorow**
3	In *Ragtime*, this famous person's car swerves into a telephone poll. This person later meets a confused Archduke Franz Ferdinand.	Harry **Houdini** [accept Erik **Weisz** or Harry **Weiss**]

Extra Question #7: Literature

10 points per part

One of the characters in this novel is nicknamed "Chicken George" because he trains chickens for cockfights.		
1	Name this novel based on its author's family history. Some of the research for this novel was done in the Gambia.	***Roots****: The Saga of an American Family*
2	This person wrote *Roots* about a decade after writing *The Autobiography of Malcolm X*.	Alex **Haley**
3	In *Roots*, this person is captured and put on a slave ship to America.	**Kunta Kinte** [accept either]

Extra Question #8: Science

10 points per part

Abegg's rule states that the difference between the maximum positive and negative valences of an element is often this number.		
1	Name this number. An oft-stated rule says that atoms seem to prefer to have this many electrons in their valence shells	**8**
2	Octane is a saturated hydrocarbon with eight carbon atoms in each molecule. How many hydrogen atoms are in each molecule?	**18** hydrogen atoms
3	A molecule of glycerin has eight hydrogen atoms. How many oxygen atoms does it have?	**three**

Extra Question #9: Science

10 points per part

The Miller index is used to categorize planes in these structures.		
1	Name these solids in which atoms, molecules, or ions are arranged in a lattice.	**crystal**s or **crystalline** solids
2	Of the seven categories of crystal systems, this one is the most symmetric, with equal distances and right angles. This system cannot be base-centered but can be primitive, body-centered, or face-centered.	**cubic** [prompt on **cube**]
3	On the other hand, this crystal system is the least symmetric. In this system, the axes are of unequal lengths and are not perpendicular.	**tri·clinic**