

Happy Festivus!

(Full disclosure: Some of the Who questions are not new and were read on the Discord)

1. *Description acceptable.* **The writer of this question once saw a GRASP Lab presentation which began by referencing this trait. This trait was partially subverted by showing a character on the deck of the *Marie Celeste* in “The Chase,” and demonstrably ended in an episode partially-titled “Remembrance.” This trait was parodied in a *Punch* cartoon with the caption, “Well, this certainly (*) buggers our plans to conquer the universe,” and it was later circumvented by levitation. The Fourth Doctor hangs his hat on an eyestalk before referencing this trait by saying “If you’re supposed to be the master race of the universe, why don’t you just climb after me?” For 10 points, name this oft-mocked quality meaning that aliens who yell “Exterminate” have to take the elevator.**

ANSWER: **inability** of the **Daleks** to climb **stairs** [accept anything indicating that Daleks can’t climb stairs] (“Remembrance” is more properly “Remembrance of the Daleks,” but, you know)

2. **In one paper, Zevallos and Choset overlaid stiffness mapping onto sensor data from this robot. To segment part of this robot from its background, Garcia-Peraza-Herrera et al created the deep learning architecture ToolNet. Ongoing research topics for this robot are automatically evaluating user skill and figuring out how to optimize camera control to avoid using a foot-pedal clutch. This robot went mildly viral when it was used on a (*) grape. Competitors to this robot include Verily’s Verb and Stryker’s Mako. This system has a leader console teleoperated by a human, and a follower console with a camera arm and two laparoscope-like arms. Due to quicker recovery time and fewer complications, this robot is often used for prostatectomies. For 10 points, name this minimally invasive robotic surgical system manufactured by Intuitive Surgical.**

ANSWER **da Vinci** Surgical System

3. **Tad McGeer created a robot of this general type with “passive” motion, demonstrating stability with Poincare maps; limit cycles are also often used to analyze these robots’ motion. Grizzle and Westervelt use hybrid zero-dynamics for the control of this type of robot. Robots in this broad category are often placed on a boom, using circular motion to simulate 1D straight-line motion - including in a very dramatic video by an MIT lab named for this type of robot, which was founded by Marc Raibert. Cassie is a robot of this type, as is the (*) Ghost Minitaur. “Pronking” or “trotting” can be performed by some of these types of robot, which often uses animal gait studies as an inspiration for motion planning. For 10 points, name this subcategory of robots exemplified by Boston Dynamics’ Spot, which does not use wheels.**

ANSWER: **legged robots** [or **bipeds** or **quadrupeds** or **walking** or **running** robots; or **legged walkers** or **bipedal walkers** or **walkers**; antiprompt on any specific robot type mentioned] (The MIT Lab is the Leg Lab.)

4. **When a man in one of these places asks him if he is alright, the Doctor says “oh yes, I just dented my head on your gun.” In another one of these places, a character says “I can only tell you what I would do if I were you” and repeats “if I were you” before tapping his nose and asking “Who knows?” Dust in another one of these places is analyzed to reveal that underneath coverings are hidden (*) Zygons, in one of these places which an older version of the Fourth Doctor retires to care for. In one of these places, a character played by John Cleese staring at the TARDIS says “one of the most curious things about this piece is its wonderful afunctionalism.” The Fourth Doctor declares “Good heavens, you’re right, she hasn’t got any eyebrows” after berating Romana for failing to appreciate an item in one of these places. For 10 points, name this type of place, one of which holds the bigger-on-the-inside *Gallifrey Falls* in the 50th anniversary special, and one of which holds the *Mona Lisa* in *City of Death*.**

ANSWER: **art museum** [prompt on **museum**; antiprompt on the **National Gallery** or the **Louvre**]

5. Fox uses the Kullback-Leibler distance as a metric for this algorithm in a paper that changes this algorithm's sample size over time. "Low variance," "regularization," or KLD techniques try to prevent a distribution in this algorithm from collapsing too early. Montemerlo and Thrun used this type of algorithm for FastSLAM. A "Rao-Blackwellized" instance of this algorithm marginalizes out some of its variables. This technique can provide a better response to nonlinearity or multimodal distributions than (*) "Extended" or "Unscented" versions of another algorithm, and it is an instance of the Bayesian filter that is especially helpful for quickly converging from the kidnapped robot problem. The steps of this algorithm are updating position based on dynamics, updating weights based on observations, and resampling. This localization algorithm can be used instead of a Kalman filter. For 10 points, name this localization technique, a filter which samples many discrete points.
ANSWER: particle filters [prompt on Bayesian filter or filter; prompt on localization algorithm]

6. In an episode with this title adjective, one character quotes "For how should man die better than facing fearful odds?" as a twenty-year old falls into a black hole. In an episode with this title adjective, the Doctor appears in a Laurel and Hardy film. One character says that another character was *this adjective* "from the beginning," in a not-aired script called "She Said, He Said," where the other character says, "The trick is, don't fall in love. I do that trick quite a lot, sometimes twice a day." This is the first adjective in an episode which first references (*) Jim the Fish in a 50s- style diner. A character declares "I blew into this world on a leaf...I don't think I'll ever land" before declaring that she is this type of person, because of her appearance in the modern day after her death in in a Dalek asylum and Victorian London. *The Satan Pit* continues a two-part episode begun by *The* [this adjective] *Planet*. Clara Oswald was known as [this adjective] Girl during her earlier episodes. For 10 points, what adjective describes the "Astronaut" that shoots the Eleventh Doctor?
ANSWER: impossible [accept Impossible Girl, Impossible Planet, or Impossible Astronaut]

7. A paper by Sturm and Maybank describes singularities that can occur during an algorithm for this task. One popular algorithm for this process involves calculating the absolute conic from a homography. A corner refinement step can help in performing this technique. The results of this technique can be described by the Brown-Conrady or plumb bob model. Targets for this process might include ArUco, or a grid of circles. The two competing most popular algorithms for this technique were developed by Tsai and (*) Zhang, whose implementation is used by OpenCV. This task is often done by waving a checkerboard around, so that the corners of the checkerboard can be compared in image space and in world space. This task can help compensate for pincushion or barrel distortion, or find a focal length. For 10 points, name this task which involves finding the intrinsic and extrinsic parameters of a camera.
ANSWER: camera calibration [accept word forms]

8. This man used the gag both in *Doctor Who* and a later work of no one noticing that a professor had been at a college for hundreds of years as long as they had tenure. That character created by this author, who leads to the creation of the Person from Porlock in another work, was the forgetful Professor Chronotis in *Doctor Who*. This author, who used the pseudonym David Agnew to edit *Doctor Who* episodes, wrote the script of an episode blocked due to a writers' strike which was released decades later in cartoon format - that episode was (*) *Shada*, which was later adapted into *Dirk Gently's Holistic Detective Agency*. For 10 points, name this editor for *Doctor Who*, who is better known for *The Hitchhiker's Guide to the Galaxy*.
ANSWER: Douglas Adams

9. Pikul developed "robotic blood" modeled off redox flow batteries for a lionfish robot of this general type. "Granular jamming" is used in end effectors with this general quality. A robot of this type by Okamura and Hawkes is inspired by "eversion growth" and extends up to 72 meters long. Shape memory alloys or dielectric elastomers are often used as actuators in this subdiscipline of robotics. It's not wall-climbing, but gecko setae were used in a gripper with this feature. A company named after this subfield of robotics focuses on (*) packaging food without damaging it. Tendons and pneumatic actuators are frequently used in this subdiscipline,

which provided the inspiration for *Into the Spider-Verse*'s Doc Ock as well as Baymax. For 10 points, name this subdiscipline of robotics, which uses compliant materials.

ANSWER: soft robotics [or compliant robotics before mention]

10. In a competition for this problem, Eppner et al used a Barrett WAM mounted on a holonomically-moving base, which they cited as a key advantage in this problem. For this problem, they made a scoring method to choose between “top” or “side” motion primitives. Machines named after a solved subset of this problem position surface-mount devices onto a PCB. SCARA and Cartesian robots are often useful for repetitive instances of this problem. (*) Amazon hosts a yearly competition for this problem. Steps in this problem typically involve instance segmentation of objects out of a cluttered environment, identifying a good grip point on that object, and planning a path from that grip point to a final destination. For 10 points, name this robotics problem which involves grasping arbitrary objects out of a bin.

ANSWER: pick-and-place

11. *Description acceptable.* One character with this quality claims to periodically “drink pomace wine” and read her diary, which has pages torn out. That character is given a device to pass this quality to one other person, but instead uses it to counteract the Eyes of Hades. While in a radiation chamber, a man with this property accuses the Doctor of being prejudiced against people with this quality. This property may possibly be possessed by a (*) child adopted by the Shobogan explorer Tecteun. It's not “being a hybrid,” but one character gains this trait from a medical kit from a Mire helmet. A being with this quality used to be a poster boy for the Boeshane Peninsula, and later, in a presumably Cumaean Sibyl-esque fashion, becomes a giant head in a jar. The Time Lords do not properly have this property, since they have a maximum number of regenerations. For 10 points each, name this property of Ashildr and Jack Harkness.

ANSWER: being immortal [accept any answer about not being able to die; do not accept or prompt on the ability to regenerate; do not accept or prompt on being ageless - Ashildr is but Jack Harkness isn't]

12. The recently released version 2 of this software uses ament as its default build tool and allows decentralized discovery of subcomponents, in contrast to the first edition, which uses catkin and requires users to always start a core. Rviz and rqt_graph are popular visualization and organization tools for this software, which allows users to call namesake “services” and store information in “bags.” The (*) TF tree is used to keep track of transforms in this system, which was developed by Willow Garage. This system uses launch files to bring up nodes, which send messages between topics. For 10 points, name this ubiquitous robotics software, whose name is short for Robot Operating System.

ANSWER: ROS [accept Robot Operating System before mention]

13. *Description acceptable.* This controversy is referenced by a character who claims “I’m cutting to the chase, I’m streamlining, I’m saving us actual minutes!” and dabs. This controversy is referenced by the subtext to an xkcd which claims to be the canonical version of Frankenstein. This argument is parodied in *World Enough and Time* when Missy claims to be a “mysterious adventurer in all of time and space” and says, “Chose it himself...trying to sound (*) mysterious, and then he realized it was a tiny bit on the nose.” One side of this argument is supported by Bessie’s license plate, an abundance of old paperback novels and comic books, and a TV movie starring Peter Cushing. For 10 points, name this argument relating to a common misconception of show name versus character name.

ANSWER: whether or not the Doctor’s name is Doctor Who

14. Fishel and Loeb developed one of these general types of the sensors, and wrote a paper about performing Bayesian exploration with it. A camera behind a thick pad lit with colored lights can be used to create one of this general type of sensors - that sensor is GelSight. One of these types of sensors has elastomeric skin and is filled with conductive fluid, and has impedance sensors and a hydrophone inside. A multi-axis one of these

sensors have two concentric rings with spaced-apart apertures, and many examples of these sensors feature a circular button on the top. These sensors, which include (*) BioTac, often work by a zig-zag patterned metal pad on top of polyimide film, which creates a varying output through a Wheatstone Bridge circuit. These sensors often contain multiple strain gauges. For 10 points, name these types of sensors frequently used in haptics, which are also known as load cells.

ANSWER: **force sensors** [or **tactile** sensors or **haptic** sensors; prompt on **strain gauges**; accept **load cells** before mention]

15, *Description acceptable.* Data from “Dragon Age: Origins” is often used as a benchmark dataset for this problem. Koenig developed “symmetry-breaking” techniques to exponentially reduce the search space of this problem. A paper named for “real-time heuristics” in this problem adapts RTAA* to BMMA*. A solution for this problem favors edges in an experience graph called “highways.” Yu and LaValle show that this problem is NP-hard, but can be reduced to a network flow problem. Algorithms for this task include priority-based search and the less-naive conflict-based search, which picks a (*) collision and recursively considers cases where a robot does not enter the cell where that collision was. Running A* many times would be a very naive approach to this problem. Swarm robotics uses this type of problem to avoid traffic jams. For 10 points, name this type of problem, which involves finding paths for multiple robots simultaneously.

ANSWER: **multi-agent path finding** [accept anything indicating finding or planning **paths** for **multiple** robots]

16. In one study, Nunez et al used this model of robot as a magician’s assistant. The author of this question participated in a study by Naomi Fitter which had this model of robots perform handclapping games. This robot has a 360 degree sonar sensor, comes with two end effectors: vacuum cup and parallel grippers, and has cameras mounted on its limbs. This robot, the mainstay of the second major robotics company founded by Rodney Brooks, is the larger sibling of the one-armed Sawyer. Arms driven by series-elastic actuators rather than directly by a motor make this robot useful as a backdrivable (*) “cobot,” and it has a screen “face” with preprogrammed expressions. For 10 points, name this friendly red robot manufactured by the now-defunct company Rethink Robotics.

ANSWER: **Baxter**

17. Characters in this episode reveal that they traveled farther and farther back in time to bribe an architect to introduce features like the Spikes of Death and the Sofa of Reasonable Comfort. It’s not about the Slitheen, but this episode heavily features farting aliens. Characters in this episode continually say to each other “I’ll explain later.” It’s not *The Witch’s Familiar*, but this episode shows the Master having to crawl through sewers. It’s not *Twice Upon a Time*, but this episode shows the Doctor saying “never be cruel, never be cowardly” before turning into a (*) woman for the thirteenth regeneration. Technically, this was the first *Doctor Who* episode written by Steven Moffat. For 10 points, name this Red Nose comedy special in which Rowan Atkinson plays the Doctor.

ANSWER: ***Curse of the Fatal Death***

18. This person defends insane asylums, saying that being in one “set [him] right again” after his son died. After reciting a work by this author, a woman screams “Bite me, alien boy!” before getting transformed via sonic screwdriver into a small action figure, which squeaks “I still ain’t bovered!” In one episode, the Doctor claims that handwriting mistaken for this author’s is actually his, because this author sprained his wrist playing croquet. Modern England is described to this man as “Freedonia,” and the Doctor remarks “Fifty-seven academics just punched the air” after this author (*) flirts with both the Doctor and his companion. This author fights the Carrionites and addresses a sonnet to Martha Jones in an episode named for this author’s “Code,” where the script of *Love’s Labours Won* is destroyed. For 10 points, name this author of *Romeo and Juliet*.

ANSWER: William **Shakespeare**

19. A paper by Florian notes that a typo in the paper popularizing this problem propagated to other papers, but did not prevent those papers' on-line learning approach from being valid. That paper by Barto, Sutton, and Anderson solves this problem with an "associative search element" and an "adaptive critic element," and adapts a "boxes system" which quantizes x , θ , \dot{x} , and $\dot{\theta}$. A Medium article by Jian Xu points out that a simple 5-line controller can beat many fancy reinforcement learning approaches used to beat this problem on (*) OpenAI Gym. The actions in this problem involve pushing an object to the left or right, and a round of this problem fails when an angle varies more than a maximum threshold. This problem involves controlling the velocity of a vehicle on a 1-dimensional track in order to swing the title object up into the air. For 10 points, name this basic underactuated controls problem, also known as the inverted pendulum problem.

ANSWER: cartpole [accept inverted pendulum before mention]

20. *Description acceptable.* One character states that "Operation Exodus" is really this type of event while another character repeats "I waited for you." The camera cuts away from showing this general action to show the outside of the Battersea Power Station while playing "The Lion Sleeps Tonight." The Doctor claims that this action "happen[s] everywhere there's people" because "like sewage and smartphones and Donald Trump, some things are just inevitable." A company that performs this action is named for the phrase (*) "don't cremate me" and persuades rich people to donate their bodies - that fake company with employees Dr. Chang and Seb is 3W. In an instance of this event which has caused the question writer to never wear AirPods again, John Lumic kidnaps homeless people and fits them with "emotional inhibitors" in *The Age of Steel*. For 10 points each, name this action, which "upgrades" people into shiny metal cyborgs.

ANSWER: creating Cybermen [accept "Genesis of the Cybermen" or upgrading or converting people to Cybermen; prompt on anything about removing emotion]

21. A Love Sprite, which "sucks your brain out through your mouth, hence the name," is found inside this object. Peter Capaldi complained that David Tennant left hair gel on this object. The Doctor wears this article of clothing while taking a picture on the site of Caliburn House every few million years and says it brings out his eyes. Orson Pink possesses a similar object to this one in *Listen*, and several of these items are worn in *Kill the Moon*. While wearing this object, the Doctor declares "if I believe in one thing, just one thing, I believe in her" in *The* (*) *Satan Pit*. The Doctor wears this article of clothing throughout *The Waters of Mars*. For 10 points, name this brightly colored article of clothing worn by Doctors Ten to Twelve to survive outside Earth's atmosphere.

ANSWER: the orange spacesuit [prompt on spacesuit]