

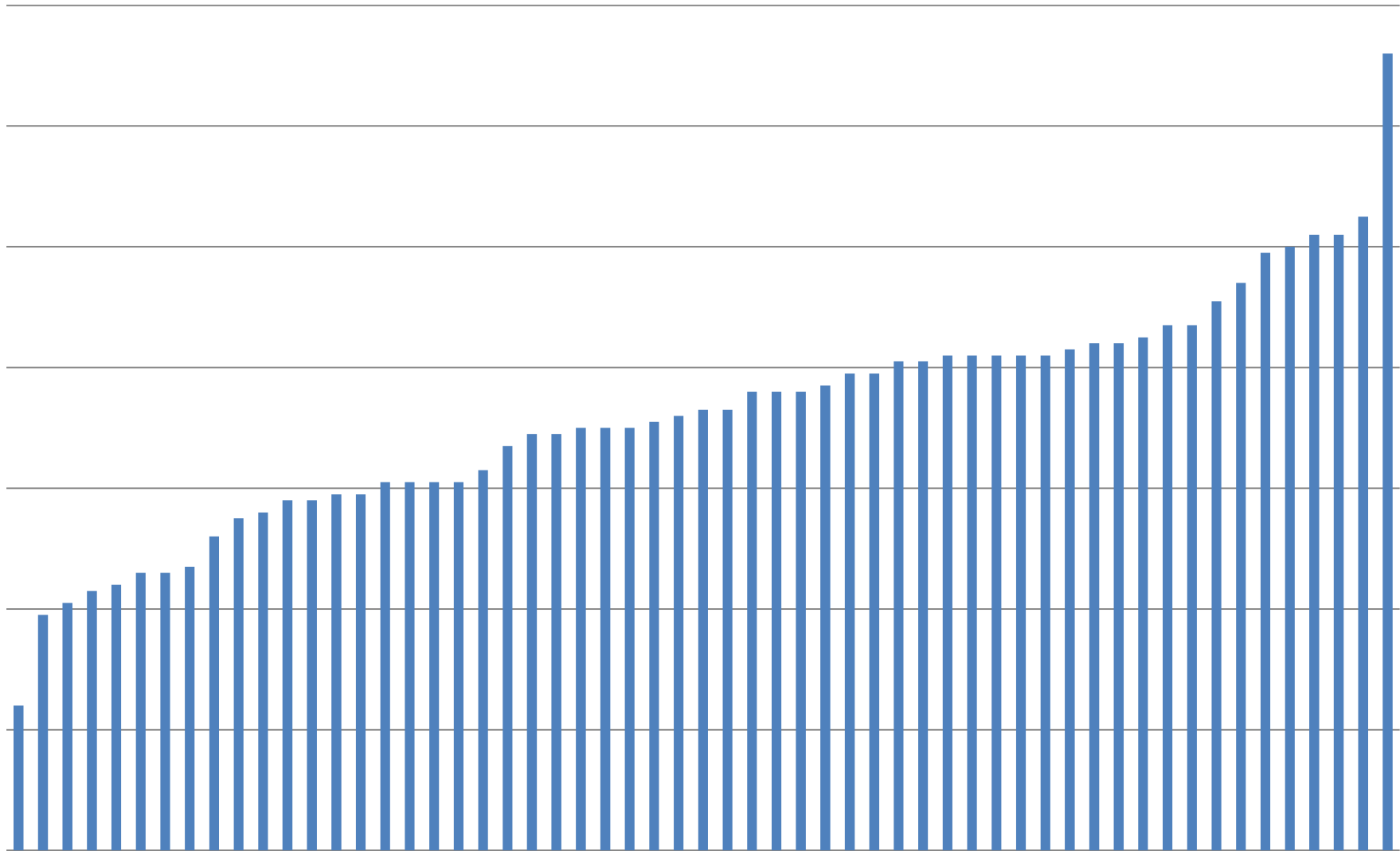
AC 2015 Post Mortem

Junior MCQ

- Easiest: Q27/Q28
 - The most common elements in the Universe are...
 - Why do stars twinkle at night?
- Most Kills: Q49 (Honourable Mention: Q19)
 - The CMB is thought to largely represent...
 - It is not light from the Big Bang itself!
 - Which statement about the seasons on Earth is true?
 - Earth is not further from the Sun during N.H winter!

JNR MCQ Score Distribution

$\mu=72.1, \sigma=19.2$

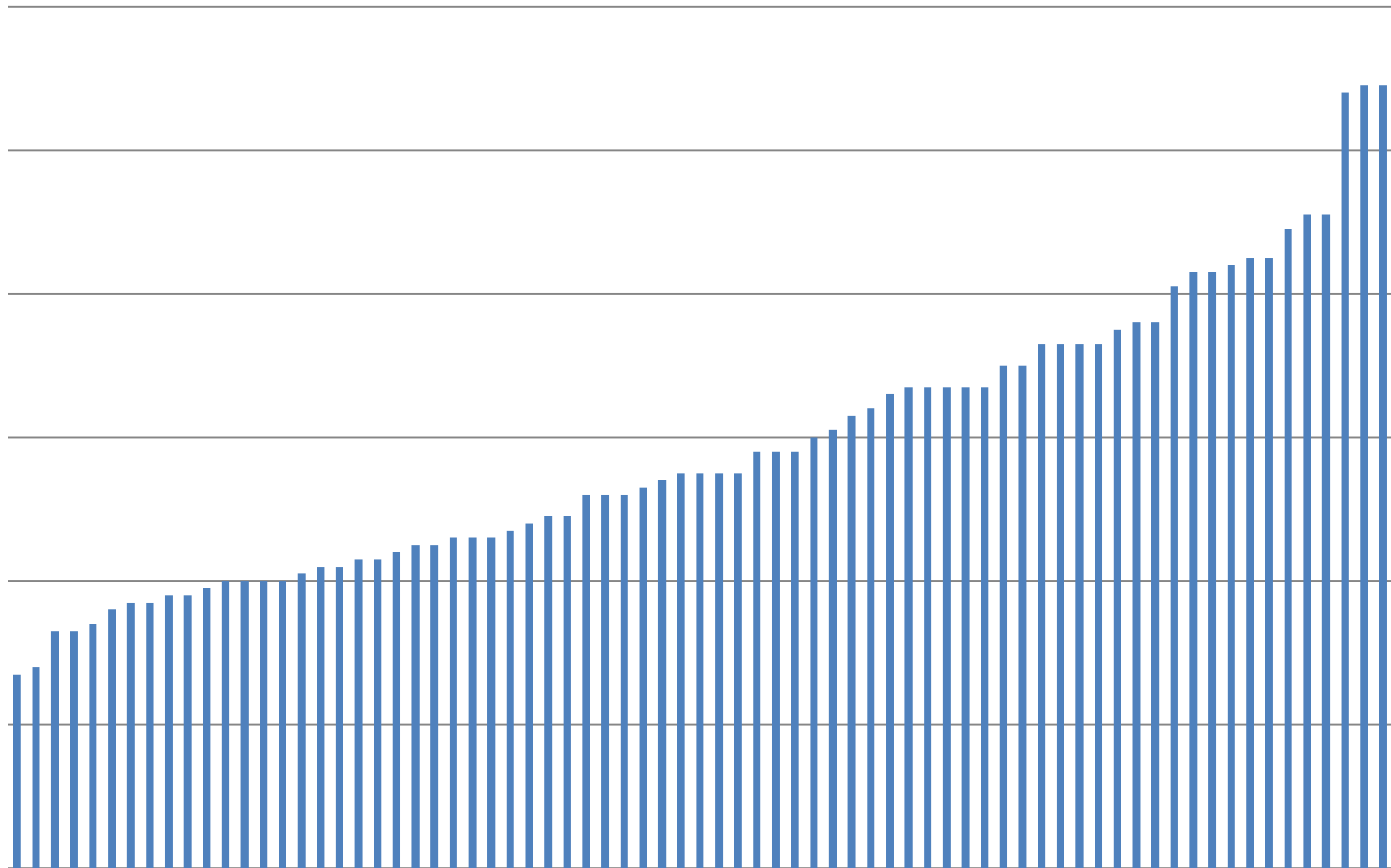


SNR MCQ

- Easiest:
 - Q1: What is the last phase of a star like our Sun?
- Most Kills: Q39 (Honourable Mention: Q26)
 - Mean motion orbital resonances occur when... Which of the following statements are true?
 - A resonance that keeps two bodies close to each other is destabilising not stabilising!
 - City A and City B have a time zone difference of 8 hours. While both cities have the same latitude, City A is east of City B by 105 degrees of longitude...
 - Parallax means that the RA/Dec of a satellite WILL differ

SNR MCQ Score Distribution

$\mu=58.7$, $\sigma=19.5$

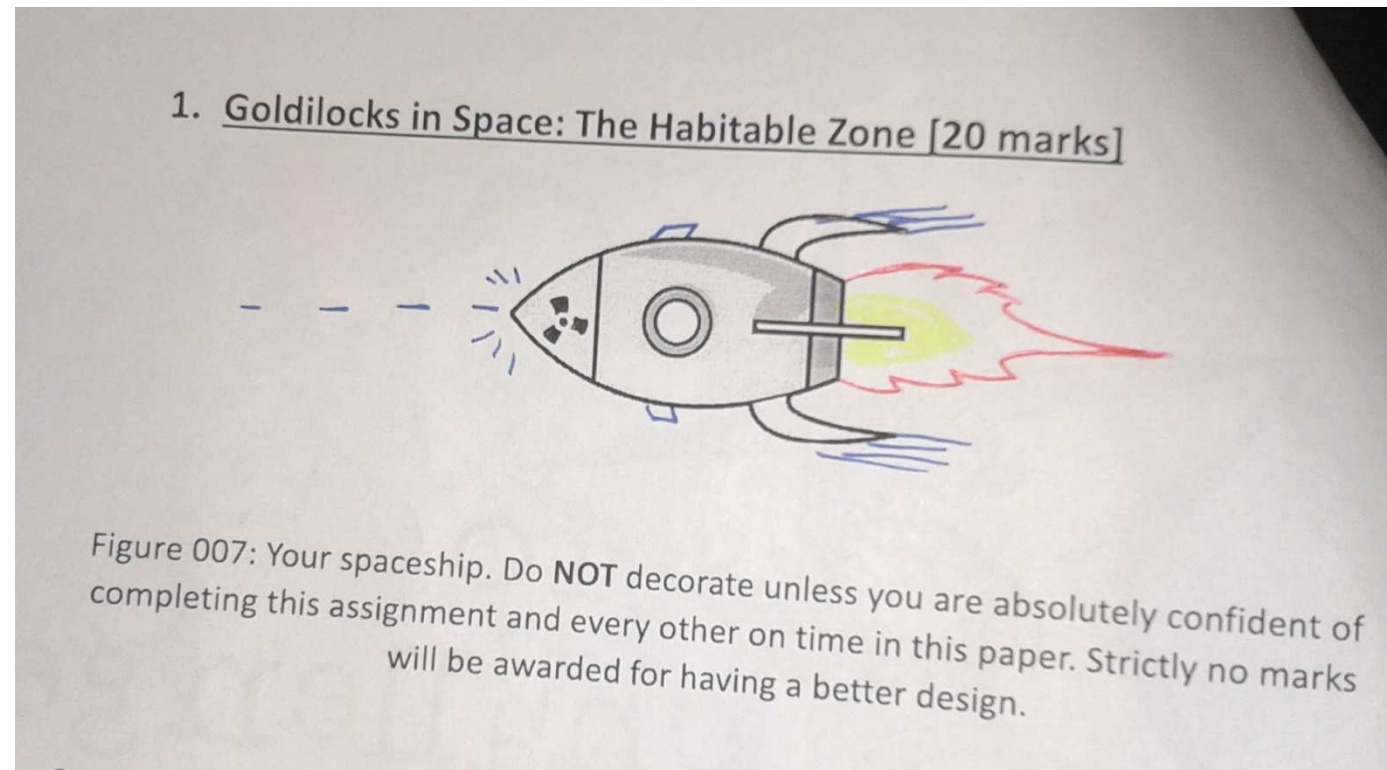


Junior DRQ

Q1: Goldilocks in Space

- I'm going to let Qi En finish, but let us congratulate ACSI Team 2 for...

Best designed spaceship!



Common mistakes

- UNITS – 1 A.U. and 1 m is a VERY BIG DIFFERENCE
 - Result: planets with surface temperatures of 10^8 degrees
- Write formulas! : cannot tell if you got the wrong answer because you had a careless mistake or used the wrong formula/ equation
- READ QUESTIONS: 2 short explanations \neq 1 long explanation

Q2: History of Astronomy

- Thankfully nobody fell asleep, though there were some logical/ factual errors
- A lot of cold jokes about Europa and jokes that are too hot to handle for Io (Ganymede and Calisto are so sad)
- Superior conjunction and opposition were mixed up for some teams!
- Background context + above = win for this

Q3:Surface Brightness and Observation Plans

- First few parts were mostly a test of how to manipulate logarithms. (ECF!)
- Many mixed up planetary nebulae with supernova remnants and other nebulae...
- Last part was poorly done
 - Even part f: plugging numbers into a given formula was surprisingly difficult...



Q4: Occultation of Jupiter

I don't know what happened...

Q4: Occultation of Jupiter

- A lot of people were scared off by a sky map + geometry?
- Some didn't know what an occultation was?
- When the Moon is at Last Quarter while occulting Jupiter, Jupiter can't possibly be at opposition...

Q5: Astronomy in Another Land

- This was one of the “easier” questions in this paper...
 - Lets hope that this strong performance was not due to luck

"Is Elliot in the Northern or Southern..."

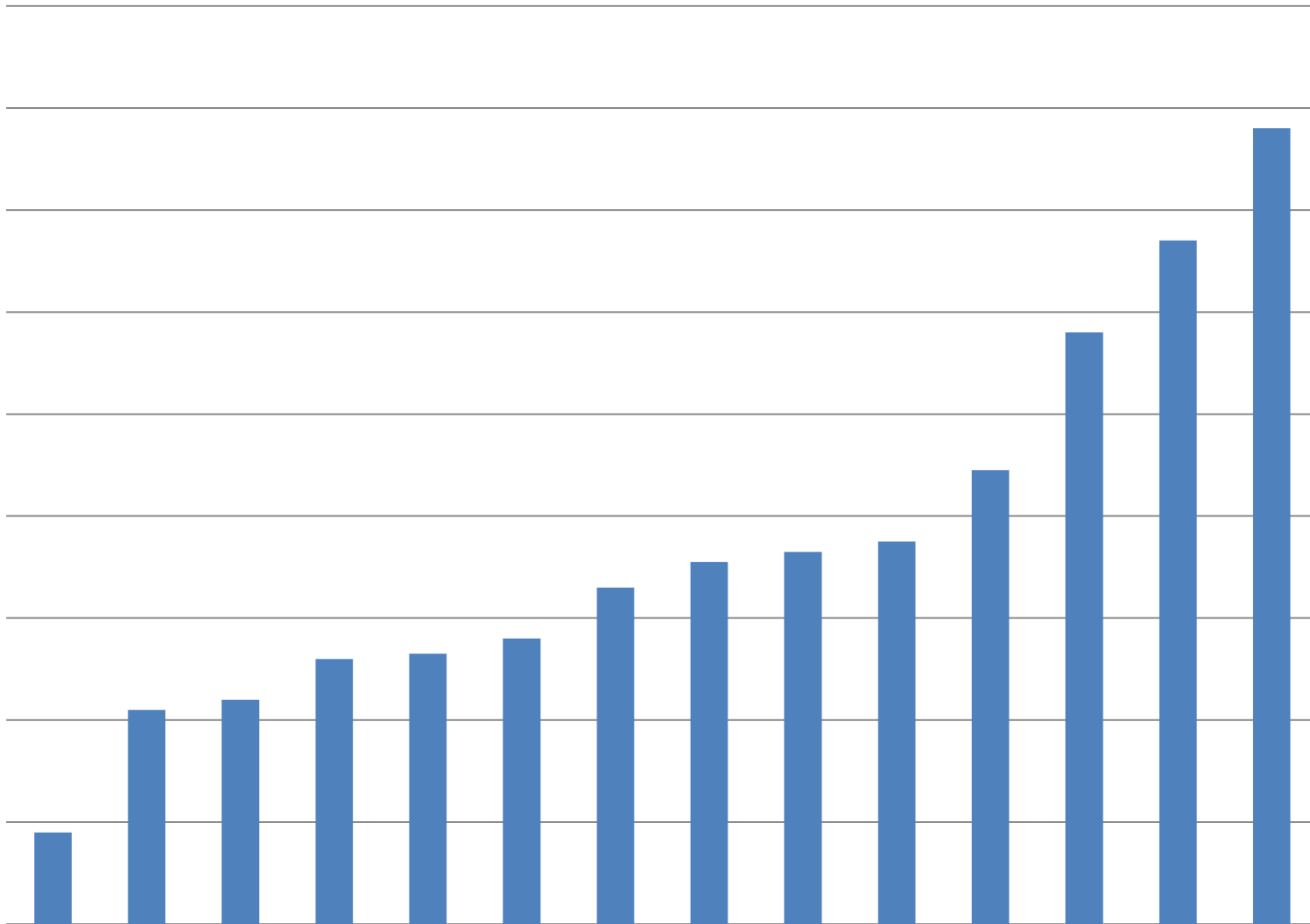
Roll dice

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- Use the night sky to find your way!
- How to do well in these type of questions:
 - Go out more!

Junior DRQ Score Distribution

$\mu=37.3, \sigma=18.3$



Senior DRQ

Q1: A Journey to Mars

Q2: Searching for Earths

- Quite a few straightaway applied the approximations without explanation, leading to some rather dubious proofs...
- Second part was reasonably done, though careless mistakes were aplenty
- Despite being told otherwise, many still reused the same arguments in the final part of the question...

Q3: Hubble's Law for Messier Spirals

- This question was really easy to score!
 - You just had to put in effort to plot the points properly and draw the correct best fit line...
- What differentiated the best from the good was the last question.
 - The unrealistic extrapolation from the 2nd graph should have cued you in to the real issue... selection bias!

Q4: The Milky Way

- It is only a relation, not an equation:

$$L \sim M^{3.5}$$

What you can do....

$$\frac{L}{L_0} = \left(\frac{M}{M_0} \right)^{3.5}$$

- Don't use the assumed answer for part e
 - Part c and d is based on assumption while part b is based on real data

Q5: Seasons in the Sun

- Even though the question involved plenty of spherical geometry, the first half was done rather well.
- Unfortunately, things went downhill from there...
 - When is $\delta_{Sun} = -23.5^\circ$?
 - When is the most favourable time to see Orion?

Q5: Seasons in the Sun

- Teams failed to **READ** the hints for the integration question, making life extremely difficult for themselves while throwing valuable marks into the wind
- $A(HA) = 1370[\cos HA \cos \delta_{sun} \cos l + \sin \delta_{sun} \sin l]$
- Since **we need to express the solar flux in terms of radians** (see Hint 2 and the question), **$C = 13,751$**
- Observe that **we can simply integrate for half a day** and multiply by 2 (see Hint 4)

Q5: Seasons in the Sun

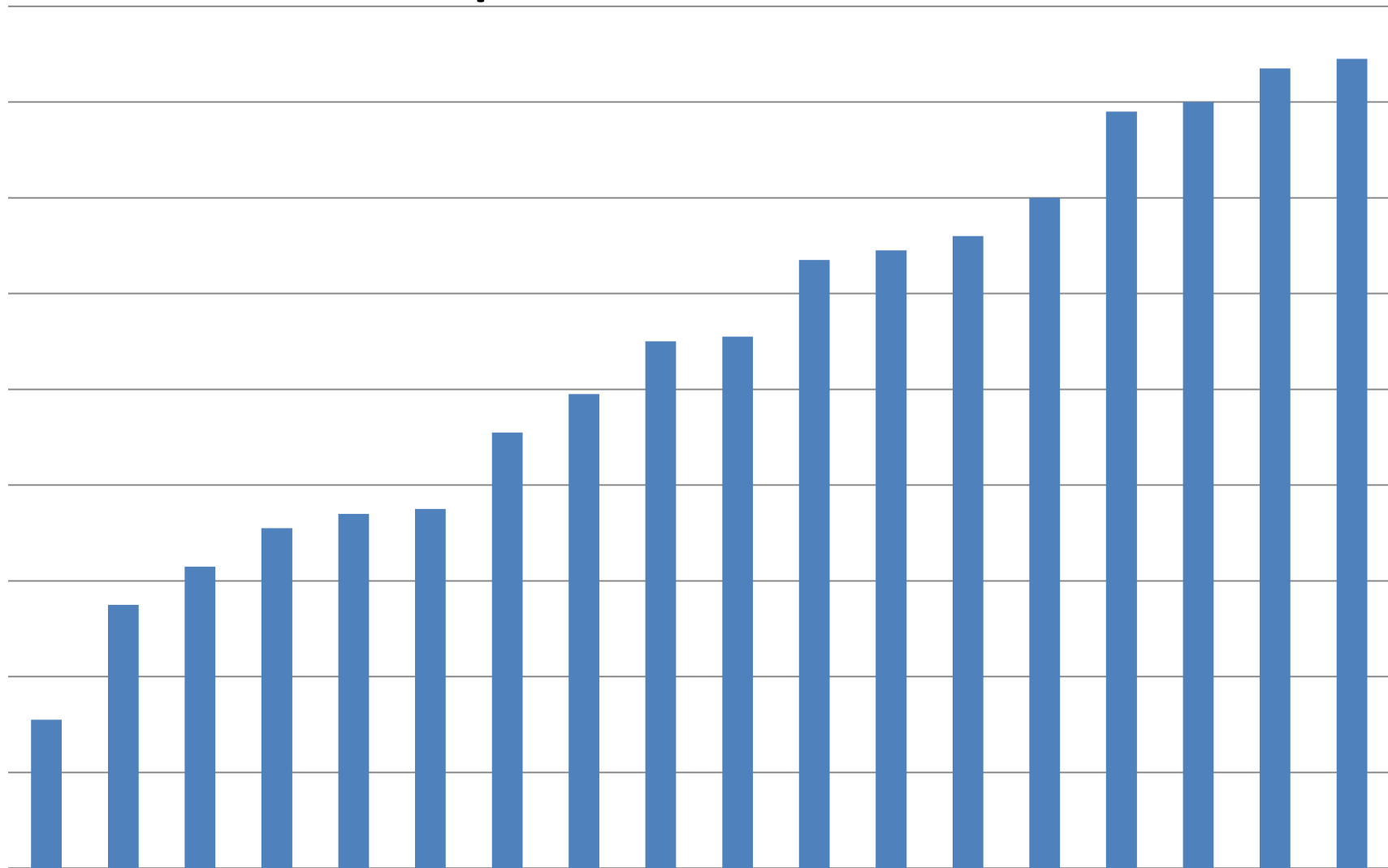
- $2(1370 \times 13751) \int_0^{0.5\pi} [\cos HA \cos \delta_{sun} \cos l + \sin \delta_{sun} \sin l] dHA$

$$= 2(1370 \times 13751) \int_0^{0.5\pi} 0.917 \cos HA dHA$$
$$= 37,677,740 [0.917 \sin HA]_0^{0.5\pi} \approx 34.55 MJ$$

- $2(1370 \times 13751) \int_0^{1.197} 0.7025 \cos HA - 0.2563 dHA$
 $= 37,677,740 [0.7025 \sin HA - 0.2563 HA]_0^{1.197}$
 $\approx 13.08 MJ$

Senior DRQ Score Distribution

$\mu=54.5, \sigma=20.3$



Observation Round

- Part I forced us to revise our prior beliefs about your familiarity with your telescope...
- Despite the weather, Part III+IV differentiated teams quite well.
 - Upsettingly common to see 5 people staring at different laptops/iPads/Google Sky Maps, while the telescope was left to stone
 - If you didn't bother to justify 'specialness' = 2.5m

Ob Round Score Distribution

$\mu=47.3, \sigma=8.3$

