# Brisbane State High School

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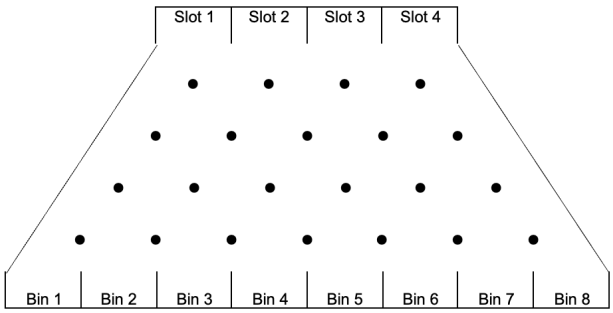
|---|---|---|
| **Student name:** | **Student number:** | |
| **Teacher name:** | | |
| **Hand out:**<br>**Term 1 Week 2**<br>**Monday 02/02/26** | **Progress Checkpoint due:**<br>**Term 1 Week 4**<br>**Tuesday 17/02/26** | **Date due:**<br>**Term 1 Week 7**<br>**Tuesday 10/03/26** |

| | |
|---|---|
| **Subject** | Year 11 Specialist Mathematics |
| **Technique** | Problem Solving and Modelling Task |
| **Unit** | Unit 1: Combinatorics, proof, vectors and matrices |
| **Topic** | Topic 1: Combinatorics |

| **Conditions** | | | |
|---|---|---|---|
| **Duration** | 4 weeks including 3 hours of class time | | |
| **Mode** | Written report | **Length** | Maximum of 10 pages and 2000 words, excluding appendices |
| **Individual/ group** | Individual responses | **Other** | - |
| **Resources available** | The use of technology is required, e.g.<br>• computer/internet<br>• spreadsheet program<br>• online financial tool<br>• calculator (scientific or graphic)<br>• other software/technology. | | |

**Context**

The Wall is a game show in which contestants answer general knowledge questions. If they are correct, they drop a ball into a *quincunx* or bean machine (as seen in the diagram), where the ball randomly bounces off pegs in the machine until it reaches a bin at the bottom.
Each bin has different prize values for the player to aim for and contestants can choose any slot to drop the ball from.



**Task**

The producers of the The Wall have asked you to:

a) Analyse the probability distribution of all bins that the ball is dropped into. Use your knowledge of combinatorics and probability to assist you in determining these values.

b) From this, you are to assign values to each bin that meet the following requirements: (all values highlighted in yellow, check your email for individual values and insert them into the table below part c)

- 1 bin with the minimum prize value of $0.
- 1 bin with the maximum prize value of Max_prize.
- 1 bin with a "Try Again". The contestant will redrop the ball from any slot.
- 1 bin with a Multiplier. The contestant will redrop the ball from any slot and the money value they get on the redrop will be multiplied by the multiplier value.
    - If the original ball drop lands in either the "Try Again" or Multiplier bins, then the "Try Again" bin is replaced with Try_again_value and the Multiplier bin is replaced with $0 for the redrop.
- Remaining bins are to have different values between the minimum and maximum prize values.
- The expected payout to the player from every ball drop is to be Expected_return $(\pm 5\%)$.
    - A redrop is considered part of the original ball drop and not a separate ball drop.

c) Based on the probability distribution from a) and the bin values determined in b), justify the best slot for a player to drop the ball into to maximise their return.

| Known bin values | Individual values |
|---|---|
| Max_prize | |
| Multiplier | |
| Try_again_value | |
| Expected_return | |

**Checkpoints**

☐ Progress checkpoint – Term 1 Week 4 – 17/02/26: Uploaded to Qlearn by 4pm.

☐ Final copy due – Term 1 Week 7 – 10/03/26: Uploaded to Qlearn by 4pm.

| Criterion | Result |
|---|---|
| **Formulate** (Assessment objectives 1, 5) | **/ 4** |
| **Solve** (Assessment objectives 1, 2, 6) | **/ 7** |
| **Evaluate** (Assessment objectives 4, 5) | **/ 5** |
| **Communicate** (Assessment objectives 3, 5) | **/ 4** |
| **Total** | **/ 20** |

| Authentication strategies |
| --- |
| • Students' progress will be documented, and copies of student responses collected at the checkpoints. |
| • Students will each produce a unique response by using individualised data and producing individualised reports. |
| • You will use plagiarism-detection software to submit your response. (ie: Turnitin) |
| • You must acknowledge all sources. |

**Specialist Maths Instrument Specific Marking Guide (2025)**

| Formulate | Marks |
|---|---|
| The student response has the following characteristics: | |
| • justified statements of important assumptions<br>• justified statements of important observations<br>• justified mathematical translation of important aspects of the task | 3 - 4 |
| • statement of a relevant assumption<br>• statement of a relevant observation<br>• mathematical translation of an aspect of the task | 1 - 2 |
| • The student response does not match any of the descriptors above | 0 |

| Solve | Marks |
|---|---|
| The student response has the following characteristics: | |
| • accurate use of mathematical knowledge for important aspects of the task<br>• efficient use of technology<br>• a complete solution | 6 - 7 |
| • use of mathematical knowledge for an important aspect of the task<br>• use of technology<br>• substantial progress towards a solution | 4 - 5 |
| • simplistic use of mathematical knowledge relevant to the task<br>• simplistic use of technology<br>• progress towards a solution | 2 - 3 |
| • inappropriate use of mathematical knowledge or technology. | 1 |
| • The student response does not match any of the descriptors above | 0 |

| Evaluate | Marks |
|---|---|
| The student response has the following characteristics: | |
| • verified results<br>• justified statements about the reasonableness of the solution by considering the assumptions<br>• justified statements about the reasonableness of the solution by considering the observations<br>• justified statements of relevant strengths of the solution<br>• justified statements of relevant limitations of the solution | 4 - 5 |
| • a verified result<br>• statement about the reasonableness of the solution by considering an assumption or observation<br>• statement of a relevant strength or relevant limitation of the solution | 2 - 3 |
| • statement about the reasonableness of a result or the solution<br>• statement of a strength or limitation. | 1 |
| • The student response does not match any of the descriptors above | 0 |

| Communicate | Marks |
|---|---|
| The student response has the following characteristics: | |
| • correct use of appropriate mathematical language<br>• logical organisation of the response, which can be read independently of the task sheet<br>• justification of decisions using mathematical reasoning | 3 - 4 |
| • use of some appropriate mathematical language<br>• adequate organisation of the response<br>• statement of a decision using mathematical reasoning. | 1 - 2 |
| • The student response does not match any of the descriptors above | 0 |