Stars & Bars (Care Packs) — Practice

CKSTEM Math Problem Solving · Grades 5–8

1 FACTORIAL · PERMUTATION · COMBINATION

From a group of 5 students, a teacher will pick 2 to carry the science kit. How many different pairs can she pick?

WORK IT OUT HERE

2 FACTORIAL · PERMUTATION · COMBINATION

A pizza shop offers 7 toppings. A kid is allowed to choose any 3 different toppings for her slice. How many different topping combinations are possible?

WORK IT OUT HERE

3 FACTORIAL · PERMUTATION · COMBINATION

A library shelf holds 9 different storybooks. A reader will borrow exactly 4 of them. How many different sets of 4 books can she borrow?

WORK IT OUT HERE

4 RESERVED SEATS

A teacher is sharing 5 identical reading badges among 3 study pods. Each pod must receive at least 1 badge. How many different distributions are possible?

WORK IT OUT HERE

5 RESERVED SEATS

A coach is handing out 6 identical water bottles among 4 sports teams. Each team must receive at least 1 bottle. How many different distributions are possible?

WORK IT OUT HERE

6 RESERVED SEATS

A volunteer is sharing 7 identical care packs among 4 shelters. Each shelter must receive at least 1 care pack. How many different distributions are possible?

WORK IT OUT HERE

7 STARS AND BARS

A teacher is sharing 8 identical stickers among 3 reading groups. Each group must receive at least 1 sticker. How many different distributions are possible?

WORK IT OUT HERE

8 STARS AND BARS

A coach is handing out 9 identical medals among 4 sports teams. Each team must get at least 1 medal. How many different distributions are possible?

WORK IT OUT HERE

9 STARS AND BARS

A librarian is sharing 12 identical bookmark sets among 5 classrooms. Each classroom must receive at least 1 bookmark set. How many different distributions are possible?

WORK IT OUT HERE

10 PICK ONE, COUNT THE REST

A teacher is sharing 8 identical journals among 3 clubs — Art, Music, and Drama. Each club must receive at least 1 journal, and Art must receive more journals than Drama. How many different distributions are possible?

WORK IT OUT HERE

11 PICK ONE, COUNT THE REST

A coach is handing out 12 identical jerseys among 3 teams — Red, Blue, and Green. Each team must get at least 1 jersey, and Red must receive more jerseys than Green. How many different distributions are possible?

WORK IT OUT HERE

12 PICK ONE, COUNT THE REST

A volunteer is sharing 15 identical care packs among 3 shelters — North, Mid, and South. Each shelter must receive at least 1 pack, and the counts must satisfy North greater than Mid greater than South. How many different distributions are possible?

WORK IT OUT HERE

13 RESERVE, THEN BARS

A gardener is sharing 7 identical seed trays among 3 community gardens. Two of the gardens must receive at least 2 trays each, and the remaining garden must receive at least 1 tray. How many different distributions are possible?

WORK IT OUT HERE

14 RESERVE, THEN BARS

A coach is handing out 12 identical medals among 4 teams. One team must get at least 3 medals, and each other team must get at least 1 medal. How many different distributions are possible?

WORK IT OUT HERE

15 RESERVE, THEN BARS

A volunteer is sharing 15 identical care packs among 5 shelters. One shelter must receive at least 4 care packs, and each other shelter must receive at least 2 care packs. How many different distributions are possible?

WORK IT OUT HERE

16 SYMMETRY HALVES

A teacher is sharing 8 identical reading badges among 3 study pods — Pod A, Pod B, and Pod C. Each pod must receive at least 1 badge, and Pod A must receive more badges than Pod B. How many different distributions are possible?

WORK IT OUT HERE

17 SYMMETRY HALVES

A coach is handing out 12 identical jerseys among 4 teams. Each team must get at least 1 jersey, and the Red team must receive more jerseys than the Blue team. How many different distributions are possible?

WORK IT OUT HERE

18 SYMMETRY HALVES

A volunteer is sharing 18 identical care packs among 4 shelters. Each shelter must receive at least 2 care packs, and the North shelter must receive more care packs than the South shelter. How many different distributions are possible?

WORK IT OUT HERE

19 CHOOSE, THEN POUR

A teacher is sharing 8 identical journals among 4 clubs. Each club must receive between 1 and 4 journals. Exactly two of the four clubs must end with an odd number of journals. How many different distributions are possible?

WORK IT OUT HERE

20 CHOOSE, THEN POUR

A coach is sharing 10 identical notebooks among 4 study groups. Each group must receive between 1 and 4 notebooks. Exactly two of the four groups must end with an even number of notebooks. How many different distributions are possible?

WORK IT OUT HERE

21 CHOOSE, THEN POUR

A volunteer is sharing 16 identical care packs among 4 shelters. Each shelter must receive between 2 and 6 care packs. Exactly two of the four shelters must end with an odd number of care packs. How many different distributions are possible?

WORK IT OUT HERE

Answer Key

Each answer comes with a hint that names the move. The tag says which video to rewatch if you are stuck.

1. 10 pairs — *Factorial · Permutation · Combination*

Use the choose shortcut: top k of n over k down to 1, with n = 5 and k = 2.

2. 35 combinations — *Factorial · Permutation · Combination*

Order of toppings on the slice does not matter, so use the choose shortcut with n = 7 and k = 3.

3. 126 sets — *Factorial · Permutation · Combination*

Sets ignore order, so apply the choose shortcut with n = 9 and k = 4.

4. 6 distributions — *Reserved Seats*

Reserve one badge per pod first, then count the ways to share the leftover badges across the 3 pods.

5. 10 distributions — *Reserved Seats*

Reserve one bottle per team first, then share the remaining bottles across the 4 teams.

6. 20 distributions — *Reserved Seats*

Reserve one care pack per shelter, then count the ways to spread the leftover packs across the 4 shelters.

7. 21 distributions — *Stars and Bars*

Reserve one sticker per group, then line up the rest as stars and choose where the 2 bars go.

8. 56 distributions — *Stars and Bars*

Reserve one medal per team, then line up the leftover medals as stars and choose 3 bar positions among the gaps.

9. 330 distributions — *Stars and Bars*

Reserve one set per classroom, then line up the rest as stars and choose 4 bar positions to split them.

10. 9 distributions — *Pick One, Count the Rest*

Fix Drama's count first; for each value count the leftover ways to share the rest between Art and Music with Art bigger than Drama, then add.

11. 25 distributions — *Pick One, Count the Rest*

Fix Green's count first; for each value count distributions where Red is larger than that value and Blue makes the rest, then add.

12. 12 distributions — *Pick One, Count the Rest*

Fix South's count first, then for each value fix Mid bigger than South and let North take the rest, summing every working case.

13. 6 distributions — *Reserve, Then Bars*

Start by giving each garden the trays it is required to keep, then use stars and bars on whatever trays are left over.

14. 84 distributions — *Reserve, Then Bars*

Reserve the mandatory minimums first, then apply stars and bars to the leftover medals across all 4 teams.

15. 35 distributions — *Reserve, Then Bars*

Reserve every shelter's required minimum first, then apply stars and bars to whatever extras remain across the 5 shelters.

16. 9 distributions — *Symmetry Halves*

Count all distributions with each pod getting at least 1, subtract the cases where Pod A equals Pod B, then halve.

17. 70 distributions — *Symmetry Halves*

Count all distributions with each team getting at least 1, subtract the cases where Red equals Blue, then halve.

18. **125 distributions** — *Symmetry Halves*

Use Symmetry Halves: start by counting every distribution with each shelter holding its required minimum, ignoring the North-versus-South rule for now.

19. **24 distributions** — *Choose, Then Pour*

Choose which 2 of the 4 clubs are the odd ones first, then for each chosen pair count the valid journal distributions and multiply.

20. **36 distributions** — *Choose, Then Pour*

Choose which 2 of the 4 groups are the even ones first, then for each chosen pair count the valid notebook distributions and multiply.

21. **60 distributions** — *Choose, Then Pour*

Choose which 2 of the 4 shelters are the odd ones first, then for each chosen pair count the valid pack distributions and multiply.