LESSON MAKER PRO

Shrink the Code

Use run-length encoding to measure space saved.

HIGH SCHOOL · FM.IP.A.32

FM.IP.A.32 "Apply methods of data compression."

NAME _____ DATE _____

COUNT EACH RUN

A run is a group of matching characters in a row. In run-length encoding, write each run as its count followed by its character, even when the count is 1. Count every character in the new code, including digits, to find how much space is saved.

WORKED EXAMPLE

Use the runs in the table, in order. Write the run-length code and find how many characters it saves.

ORIGINAL RUNS

Character	Run length
H	7
J	9

1. The original has 7 + 9 = 16 characters.
2. The code is 7H9J, which has 4 characters.
3. It saves 16 - 4 = 12 characters.

Answer: 7H9J; 12 characters saved

PRACTICE 4 problems

1 Encode AAABBBBB. How many characters are saved?

ANSWER _____

2 Decode 5R3S. How many characters are in the original?

ANSWER _____

3 Encode ABAB. How many extra characters does the code use?

ANSWER _____

4 Which saves more characters, MMMMNNNN or PPPPPQ? How many more?

ANSWER _____

APPLY IT Show your work

1 A game stores a row of pixel colors using the runs in the table, in order. Each character uses one byte. How many bytes does run-length encoding save?

PIXEL COLOR RUNS

Color	Run length
B	5
G	3
B	5

ANSWER _____

2 A concert ticket has a border code made of 12 K's in a row. Each character uses one byte. Write the run-length code and find how many bytes it saves.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A 19-character art code has three runs. Each run has at most 9 characters. How many characters does run-length encoding save? Explain.

WORK SPACE AND ANSWER

ANSWER KEY

Shrink the Code

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Encode AAABBBBB. How many characters are saved?	**3A5B; 4 characters saved**
2	Decode 5R3S. How many characters are in the original?	**RRRRRSSS; 8 characters**
3	Encode ABAB. How many extra characters does the code use?	**1A1B1A1B; 4 extra characters**
4	Which saves more characters, MMMMNNNN or PPPPPQ? How many more?	**MMMMNNNN; 2 more characters saved**

PART 2 · APPLY IT

1. **7 bytes** The original uses 5 + 3 + 5 = 13 bytes. The code 5B3G5B uses 6 bytes, so it saves 7 bytes.
2. **12K; 9 bytes saved** The code 12K uses 3 bytes because both digits count. It saves 12 - 3 = 9 bytes.

CHALLENGE

13 characters. Each run becomes two characters, so the new code has 3 x 2 = 6 characters. It saves 19 - 6 = 13 characters.

Count digits as characters. The two B runs in the game problem stay separate because the G run is between them.