## Answer Teaser 3121 - Nicky Davis

For $n$ questions the possible non-positive total marks for the test are $0,-1,-2,-3, \ldots \ldots-n$, a total of $n+1$ possible test results.
The positive test results, with m as the marks given for a correct answer, can be written in columns:


The first column has from 1 to n correct answers, with any other questions not attempted.
The second column has from 1 to $\mathrm{n}-1$ correct answers, 1 incorrect answer, with any other questions not attempted
The third column has from 1 to $\mathrm{n}-2$ correct answers, 2 incorrect answers, with any other questions not attempted.
Etc.

The number $T$ of possible test results if $m=1$ is the $n$ possible test results from the first column plus the $n+1$ non-positive results: $T=2 n+1$ For $\mathrm{m}=1$ all other columns duplicate other results.
For $m=2$ the $n-1$ possible test results from the second column need to be added then all other columns duplicate other results.
For $m=3$ the $n-2$ possible test results from the third column also need to be added then all other columns duplicate other results.
Etc.
Tabulating values of T for different n and number of columns included gives Tm:

| $\underline{n}$ | $\underline{T 1=2 n+1}$ | $\underline{T} 2=T 1+n-1$ | $\underline{T 3}=T 2+n-2$ | $T 4=T 3+n-3$ | T5=T4+n-4 | $\underline{T 6=T 5+n-5}$ | $\underline{T 7}=T 6+n-6$ | $\underline{T 8=T 7+n-7}$ | $\underline{T 9}=T 8+n-8$ | $\underline{T 10}=T 9+n-9$ | $\underline{T 11=T 10+n-10}$ |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 13 | 27 | 39 | 50 | 60 | 69 | 77 | 84 | 90 | 95 | 99 | 102 |
| 14 | 29 | 42 | 54 | 65 | 75 | 84 | 92 | 99 | 105 |  |  |
| 15 | 31 | 45 | 58 | 70 | 81 | 91 | 100 |  |  |  |  |
| 16 | 33 | 48 | 62 | 75 | 87 | 98 | 108 |  |  |  |  |
| 17 | 35 | 51 | 66 | 80 | 93 | 105 |  |  |  |  |  |
| 18 | 37 | 54 | 70 | 85 | 99 | 112 |  |  |  |  |  |
| 19 | 39 | 57 | 74 | 90 | 105 |  |  |  |  |  |  |
| 20 | 41 | 60 | 78 | 95 | 111 |  |  |  |  |  |  |
| 21 | 43 | 63 | 82 | 100 |  |  |  |  |  |  |  |
| 22 | 45 | 66 | 86 | 105 |  |  |  |  |  |  |  |
| 23 | 47 | 69 | 90 | 110 |  |  |  |  |  |  |  |
| 24 | 49 | 72 | 94 | 115 |  |  |  |  |  |  |  |
| 25 | 51 | 75 | 98 | 120 |  |  |  |  |  |  |  |
| 26 | 53 | 78 | 102 |  |  |  |  |  |  |  |  |
| 27 | 55 | 81 | 106 |  |  |  |  |  |  |  |  |
| 28 | 57 | 84 | 110 |  |  |  |  |  |  |  |  |
| 29 | 59 | 87 | 114 |  |  |  |  |  |  |  |  |
| 30 | 61 | 90 | 118 |  |  |  |  |  |  |  |  |
| 31 | 63 | 93 | 122 |  |  |  |  |  |  |  |  |
| 32 | 65 | 96 | 126 |  |  |  |  |  |  |  |  |
| 33 | 67 | 99 | 130 |  |  |  |  |  |  |  |  |
| 34 | 69 | 102 |  |  |  |  |  |  |  |  |  |

For lower $n, T=100$ is not reached. For higher $n, T=2 n+1$ which is odd so cannot be 100 .
The only two cases that give $T=100$ are $n=15, m=7$, for which highest mark $n m=105$ and $n=21, m=4$, for which highest mark $n m=84$.
Answer $=105$

