Problem I – Travelling the Mars

After finish his Ph.D in image processing, Little Long joins the National Aeronautics and Space Administration (NASA) to work on a very challenging project. He is in a group with other scientists to collect information about the Mars.

Scientists from NASA commonly use the *ring-strip coordinate system* when exploring the Mars. This system is defined as follows:

- The Mars is assuming to be a completely perfect sphere with radius of 100.
- The surface of the Mars is imaginarily divided using M rings (labeled $0, 1, 2, \ldots, M-1$) and N strips (labeled $0, 1, 2, \ldots, N-1$) as illustrated in the next figure. The intersection of a strip and a ring is called a *zone*. In total, there are $M \times N$ zones.
- All strips are identical in shapes.
- M rings divide edges of any strip into M equal arcs (i.e. any line of longitude travels the same distance in each ring).

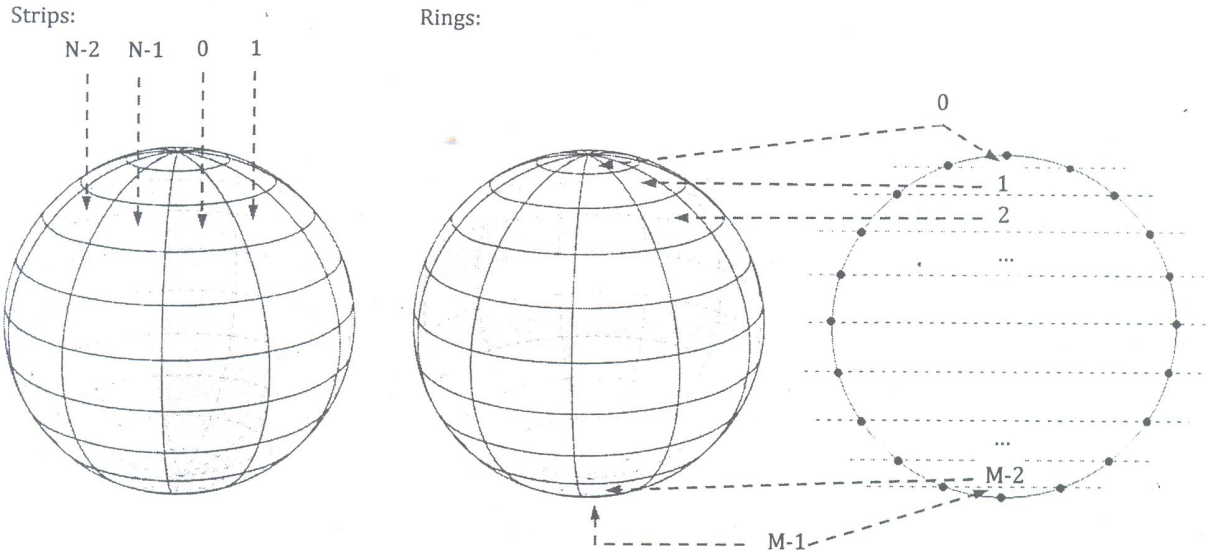

Figure 2: Illustration of *strip* and *ring*.

NASA scientists are developing a new-generation robot for exploring the Mars. The robot is programmed to perform the following routine:

- Landing on the Mars at zone A (the entry zone).
- Robot plans a route to zone B (the return zone). A route is defined as a sequence of **adjacent zones** which starts at A and ends at B. Two zones are adjacent if they have at least one point in common.
- Robot follows the route to navigate from A to B. Every time passing by a zone (included A and B), robot captures one image of the entire zone and send it back to the Earth as a radio signal. The size of the image is naturally proportional to the surface area of the zone. We call the total surface area of all zones in the route **the surface area of the route.**
- After sending the last photo, robot returns to the Earth.