FUNDAMENTALS OF WEAVING:

TANA BANA

ADITI KARRA I BD/21/1549

Fundamentals of Weaving document
Chennai, Tamil Nadu.

Documented by Aditi Karra
Centre: Chennai

Faculty mentor: Mr. Kumaraguru K

Acknowledgement

I would like to extend my sincere gratitude to the Director of The National Institute of Fashion Technology, Chennai, Dr. Anitha Manohar for providing us with the facilities and education needed to complete this document.

I am thankful for the opportunities provided to us by the Department of Textile Design and would like to extend my gratitude to my professor, Mr. Kumaraguru K. for his support.
This project enabled me to learn and explore the types of basic weaves, their structures, characteristics and uses. Additionally, it allowed me to experience the art of hand weaving and create swatches, the specifications of which are documented in this record.
I would also like to thank the weaving lab assistant, Ms Dhanalakshmi, whose constant support, experience and guidance during the practical hours helped bring this project to fruition. Additionally, I would like to thank my classmates and lab partner for their support in the timely completion of this project.

Preface

Weaving is an ancient craft with roots extending back millennia. It involves intertwining threads to form fabrics, resulting in a vibrant tapestry of cultural heritage and creativity. Across various civilizations, from the intricate patterns of Indian handlooms to the colourful textiles of West African kente cloth, weaving has played a pivotal role in expressing identity and tradition. Weaving transcends its practical aspects; it serves as a silent narrator of culture, history, and human connection. As we explore the mesmerizing world of weaving, we unravel the threads that bind us to our origins, unveiling the timeless beauty born from the rhythmic embrace of the loom.

CONTENTS

1 WEAVING 08

- Introduction to Weaving 10
- Looms and their Classification 12
- Introduction to Handloom 16
- Parts of a Loom 18
- Weaving tools and Equipment 19

2 WEAVING PROCESS 20

- Pre-Process 22
- Primary and Secondary motions 24
- Yarn calculations for weaving 26
- Post Process 26

3 SWATCH DEVELOPMENT AND DETAILS 28

- Swatch One 30
- Swatch Two 34
- Swatch Three 44
- Swatch Four 52

4 INSIGHTS AND ANNEXURE 62

- Learning outcome 64
- Glossary 64
- Bibliography 65

1 WEAVING

Introduction to Weaving

Weaving is a method of textile production that involves the interlacing of yarn at right angles to form a fabric. Some other methods of textile production include knitting, crocheting, felting and braiding. Two types of yarn are used in the weaving process. The vertical or longitudinal yarn is known as the warp yarn. They are also known as ends. The warp is attached to the loom. The yarn inserted horizontally is known as weft or filling yarn. They are also known as picks.

There are three basic types of weaves: Plain weave, Twill weave and Satin/Sateen weave.

Plain Weave

Plain is the simplest weave, in which warp and weft threads interlace alternately, giving the maximum number of interlacements. This maximum interlacement imparts firmness and stability to the structure. At least two ends and two picks are required to weave its basic unit. A minimum of two heald frames are required for this weave. It is used in cambric, muslin, blanket, canvas, dhoti, saree, shirting, suiting etc.

It is of three types:

- warp rib
- weft rib
- matt rib

Twill Weave

Twill weave is another basic weave, which is well known for its diagonal line formation in the fabric due to its interlacing pattern. This weave and its derivatives are used for ornamental purposes. Twill has a closer setting of yarns due to less interlacement imparting greater weight and good drape as compared to the plain weave.

In simple twill, the outward and upward movement of the interlacing pattern is always one that imparts a diagonal line to this design. The direction of the propagation of the twill line classifies twill into right-hand or left-hand twill. Twill weaves find a wide range of applications such as drill cloth, khaki uniforms, denim cloth, blankets, shirtings, hangings and soft furnishings. Twill weaves are of the following types

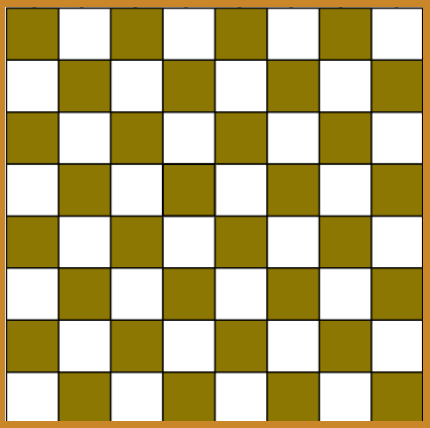
- Ordinary or continuous twill
- Zig zag, pointed or wavy twill
- Combination twill
- Broken twill
- Herringbone twill
- Diamond twill

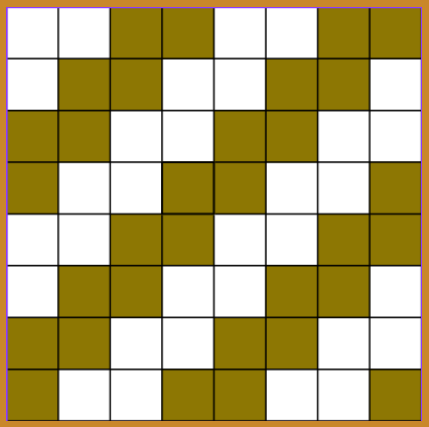
Satin/ Sateen Weave

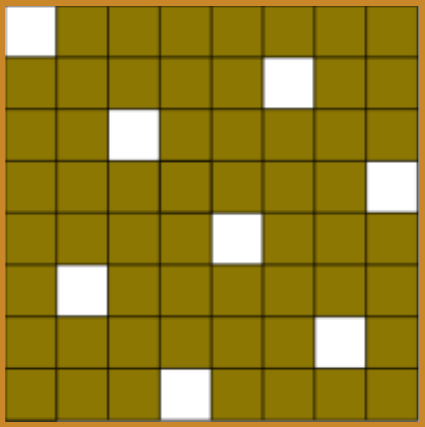
Satin/sateen is a basic weave that does not have any regular pattern like twill. The surface of the fabric is either warp or weft-faced. Satin is warp-faced, which means that all the surfaces of the fabric will

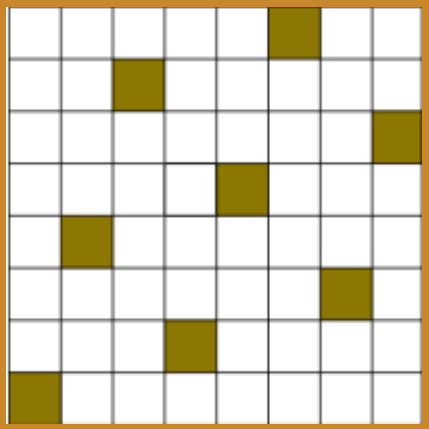
show the warp threads except for the one thread interlacement with other series of yarn. If it is weft-faced, then it will be known as sateen, which means that fabric surface will show the weft threads mostly. These weaves have the least interlacement points among the basic weaves. Due to this reason, it gives the surface of the fabric more lustre and smoothness. It is used in sarees, blouse materials, dress materials, bedspreads, furnishing fabrics, curtain fabrics etc. Some basic satin/sateen weaves are:

- 4 harness satin/sateen weave
- 5 harness satin/sateen weave
- 8 harness satin/sateen weave









Looms and their Classification

Cloth is usually woven on a loom, a device that holds the warp threads in place while filling threads are woven through them. In weaving technology; the loom is the principal mechanical device for weaving. Pit loom is the first loom in loom history. Subsequently, the handloom was developed and then the power loom. Now, various types of loom are used for producing fabric.Looms can be classified based on their use of electricity and based on the requirement of a shuttle.

Generally classification of loom in two types. They are-

- Handloom
- Power loom

Loom is also classified into two types depending on the shuttle:

- Shuttle Loom: The shuttle loom is that loom where weft yarn is inserted through the warp yarn using the shuttle.
- Shuttleless Loom: In a shuttleless loom, the weft yarn is inserted through the warp yarn using a projectile, rapier, air jet or water.

HANDLOOM

A 'handloom' is a loom that is used to weave cloth without the use of any electricity. Hand weaving is done on pit looms or frame looms generally located in weavers' homes.

PIT LOOM

A pit Loom' is a type of loom that is fit in a pit where the artisan makes the rug through the use of pedals, and normally the base of the pit loom is stronger than the primitive handloom. It is also called a treadle loom.

FRAME LOOM

A frame loom is the most basic of all weaving looms used by weavers to create woven designs. Historically frame looms were smaller, portable looms made of wood, resembling a picture frame.

CHITTARANJAN LOOM

Chittaranjan loom is one of the type of semi-automatic loom which is made of iron and wood. It ensures uniformity in the insertion of picks per inch by the use of the five wheels' positive take-up motion.

HATTERSLEY LOOM

Hattersley loom is lighter than the power loom. Here, a five-wheel take-up motion is used for completing take-up actions. All motions are automatically operated.

POWERLOOM

Powerloom is a kind of machinery that works with electric power to make a piece of fabric. Powerloom is used for making yarn to fabric in a short period. The production rate of powerloom is much faster than handloom.

PROJECTILE LOOM

A projectile weaving machine is a shuttleless loom method for filling yarn insertion using a small metal device resembling a bullet in appearance with a clamp for gripping the yarn at one end, which is then propelled into and through the shed.

AIRJET LOOM

An air-jet loom is a shuttleless loom that uses a jet of air to propel the weft yarn through the warp shed

WATERJET LOOM

A water-jet loom is a shuttleless loom that uses a jet of water to propel the weft yarn through the warp shed.

RAPIER LOOM

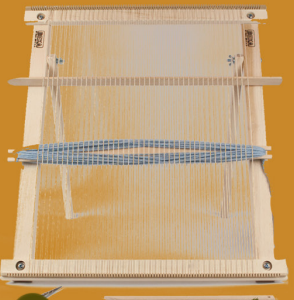
A rapier loom is a shuttleless weaving loom in which the filling yarn is carried through the shed of warp yarns to the other side of the loom by finger-like carriers called rapiers.

MULTIPHASE LOOM

Multiphase looms are considered to be the third generation of weaving machines. One of the latest multiphase looms can produce 1.5 yards of fabric in one minute. In multiphase weft insertion systems, several weft threads are inserted at the same time.

1 HAND LOOM

2 PIT LOOM



3 FRAME LOOM

4 CHITTARANJAN LOOM

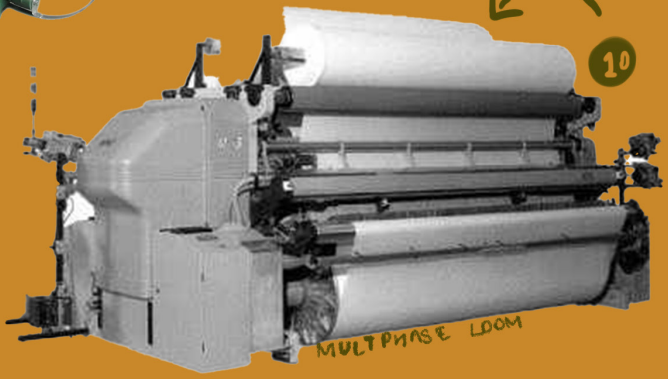
5 HATTERSLEY LOOM

6 POWER LOOM

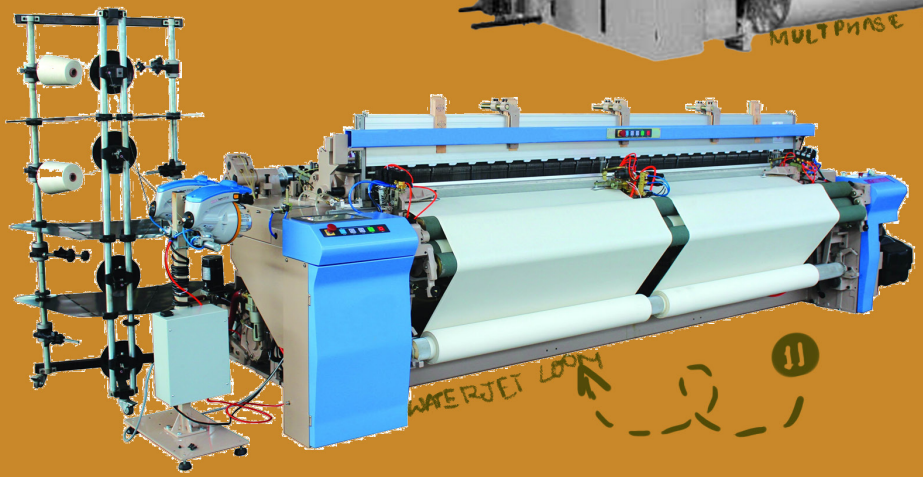
7 AIRJET LOOM

8 RAPIER LOOM

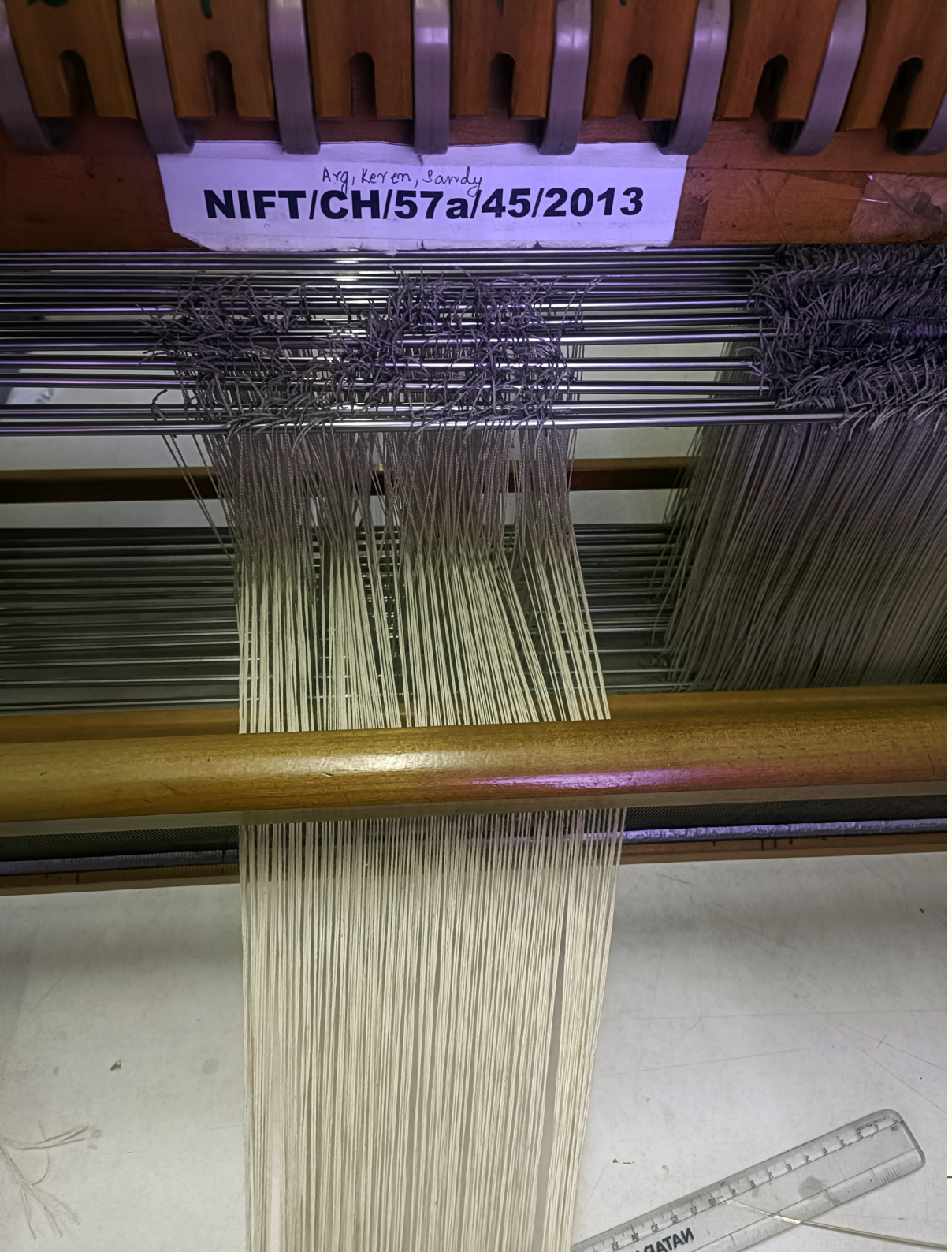
PROJECTILE LOOM 9



10 MULTIPHASE LOOM



WATERJET LOOM 11



Tana Bana

Introduction to Handlooms

A 'handloom' is a loom that is used to weave cloth without the use of any electricity. Hand weaving is done on pit looms or frame looms generally located in weavers' homes. Weaving is primarily the interlacing of two sets of yarn – the warp (length) and the weft (width). The equipment that facilitates this interlacing is the loom.

Yarn spun by hand is known as "handspun yarn" and yarn spun by machines is called "mill-spun yarn". Fabrics woven out of hand-spun yarn on handlooms are called "khadi", while mill-spun yarn woven on handlooms are called "handloom" fabrics.

The handloom experience (soft, comfortable and durable) is due to the human handling of the yarn in the weaving process. As a result, yarn and the fabric are much less stressed and damaged. Hand-woven cotton is known for its breathability as compared to mill-made cotton. This implies that it allows more air penetration making it cooler, softer and more absorbent. It keeps you cooler in summer and warm in winter.

Characteristics of Handloom Fabrics

UNIQUENESS

No two hand-loomed fabrics are the same and that's the beauty of the fabric.

VARIETY

Handloom allows the weaver to have total control of the creative process which encourages them to come up with innovative weaving patterns and designs.

QUALITY

Handloom fabrics are generally made with high-quality natural fibres like cotton, linen, silk, and wool which are resilient and last for a long time.

COMFORT

Handlooms feel significantly better against the skin compared to power looms. Handlooms are also more absorbent and breathable.

ECO-FRIENDLY

The handloom industry is a perfect example of sustainable production. Every step of the handloom process is sustainable. The natural fibres used are biodegradable.

Parts of a Loom

Heald Shaft
The heald shaft is made of wood or metal such as aluminium. It carries several heald wires through which the ends of the warp sheet pass. The heald shafts are also known as 'heald frames' or 'heald staves'. The number of heald shafts depends on the warp repeat of the weave.

Heald Wire
Used to lead the warp yarns to move in a lifting motion, forming a weaving shed for weft yarns to be brought in. Can be metallic or nylon.

Heald Eye
Small eyelets through which warp yarn passes

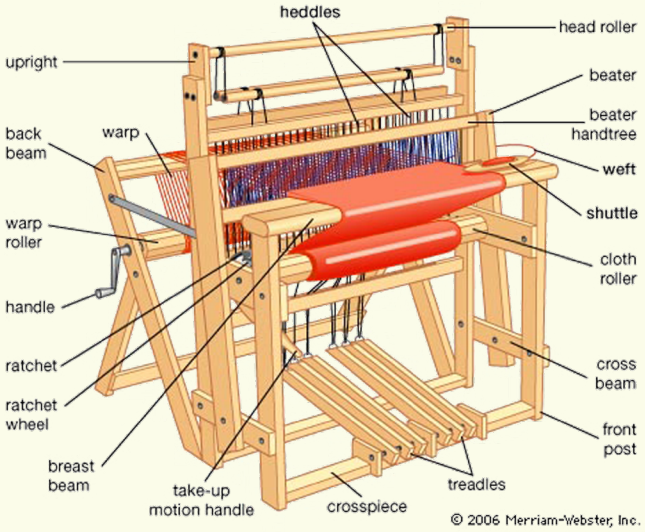
Reed
Used to separate and space the warp threads, guide the shuttle's motion across the loom, and push the threads into place

Warp Beam
The roller on which the warp threads are wound, and from which they are drawn as the weaving proceeds.

Cloth Roll
The roller on which the fabric is wound after the beat-up motionweft threads into place.

Lifting Lever/Treadle
The treadles on a loom are the pedals/levers that control how the weaving structure forms as you weave. You attach one or more harnesses to each treadle so that when you step on/lift the treadle, its movement moves the harness creating a space or shed that you can throw your shuttle through.

Base Rod
The warp ends are tied onto this rod which is attached to either (back/front) rest

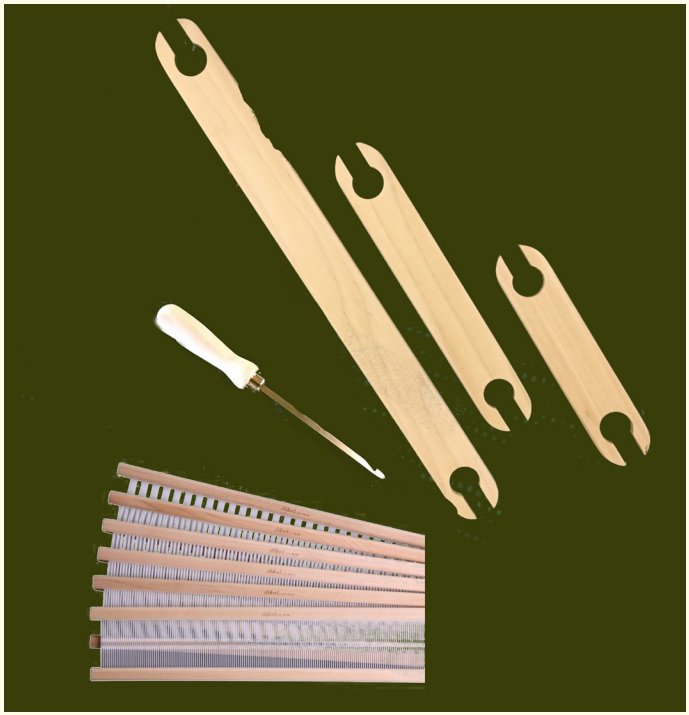


Weaving tools and Equipment

Shuttle
A shuttle is a tool designed to neatly and compactly store a holder that carries the thread of the weft yarn while weaving with a loom.

Reed
A reed is a device used to pack the inserted weft yarn to make a cloth.

Reed Hook
An instrument that is used to draw the warp yarn through the healed eyes and reed dents



2 WEAVING PROCESS

Weaving Pre-processes

SORTING THE HANK
Stretch the hank using your arms to detangle it and straighten the yarns. Find the knot and undo it and fix it onto the charkha/ spinning wheel.

WINDING
Find the outer loose end of the hank and start winding the yarn onto the bobbin.

WARPING
Convert the yarn packages (Bobbin) into a warper's beam using a peg frame and creel, having the desired width and containing a requisite number of ends. Uniform tension should be maintained on individual yarns during warping.

BEAMING
Beaming comprises winding the full width of the warp yarns in a single winding operation on the weaving beam (i.e. the beam that is to be placed on the loom)

DRAWING
Drawing consists of two processes. The first process is called Drafting and the second process is called denting. A process of passing the end through the eye of heald wire or harness according to the draft is called drafting.

DRAFTING
When the drafting is performed manually, two persons do this job. The person who selects the ends and presents them for drawing is called the reacher. The person who draws the ends through the eye of heald wire with the help of a drawing hook is called a drawer.
The types of drafts are: straight draft, pointed draft, skip draft, broken draft, divided draft, and grouped draft.

DENTING
Denting is the process of passing the ends through the dents of the reed according to the denting order of the fabric to be woven

TYING
Tying the ends to ensure that the weft stays in place and tension is maintained while weaving

Primary and Secondary Motions

The fundamental motion of a loom is called primary motion. After primary motion most important motion is secondary motion. If weaving is to be continuous then these mechanisms are essential. The loom motions which help to weave a fabric continuously are called secondary loom motions. Though the fabric can be woven without these motions, you can't keep the weaving process continuing without the secondary motions of the loom.

PRIMARY MOTIONS ON THE LOOM

Shedding: Separating the warp threads, which run down the fabric, into two layers to form a tunnel known as the shed.

Picking: Passing the weft thread, which traverses across the fabric, through the shed.

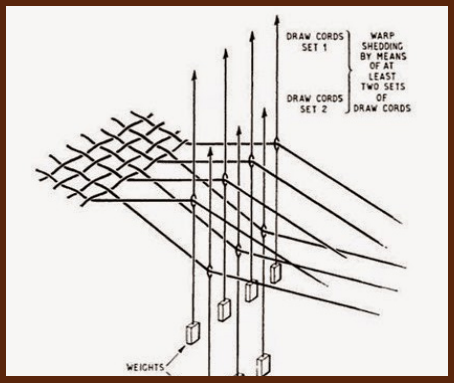
Beating-up: Pushing the newly inserted length of weft, known as the pick, into the already woven fabric at a point known as the fell

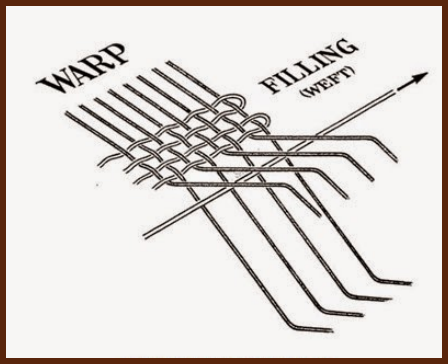
SECONDARY MOTIONS ON THE LOOM

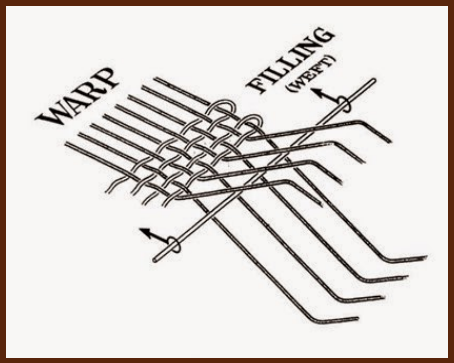
Two additional operations are essential if weaving is to be continuous:

Warp control (or let-off): this motion delivers warp to die weaving area at the required rate and a suitable constant tension by unwinding it from a flanged tube known as the weaver's beam.

Cloth control (or take-up): this motion withdraws fabrics from the weaving area at the constant rate that will give the required pick-spacing and then winds it onto a roller.







Weaving Calculations

SIZE OF THE SAMPLE: 6 inches* 6 inches
Width of body=5.5 inches
Width of selvedge= 0.5 inches (divided between 2 selvedges, each of 0.25-inch width)
Straight Draft
Length of warp = 4m
Warp count 2/20s
Weft Count 2/20s
Reed=32 count
Dent gaps in 2 inches= 32
Dent gaps in 1 inch= 16

CALCULATIONS FOR THE BODY:
Number of ends per inch= number of dent gaps in an inch* number of yarns in each dent gap
For the body, we insert 2 yarns per dent gap
Number of ends per inch= 16*2
Number of ends per inch= 32
Number of ends in the body= 32*5.5
=176 ends

CALCULATIONS FOR THE SELVEDGE:
Number of ends per inch= number of dent gaps in an inch* number of yarns in each dent gap
For the selvedge, we insert 4 yarns per dent gap
Number of ends per inch= 16*4
Number of ends per inch= 64
Number of ends in the selvedge = 64*0.5
=32 ends

Total number of ends = 208 ends

Weaving Post Process

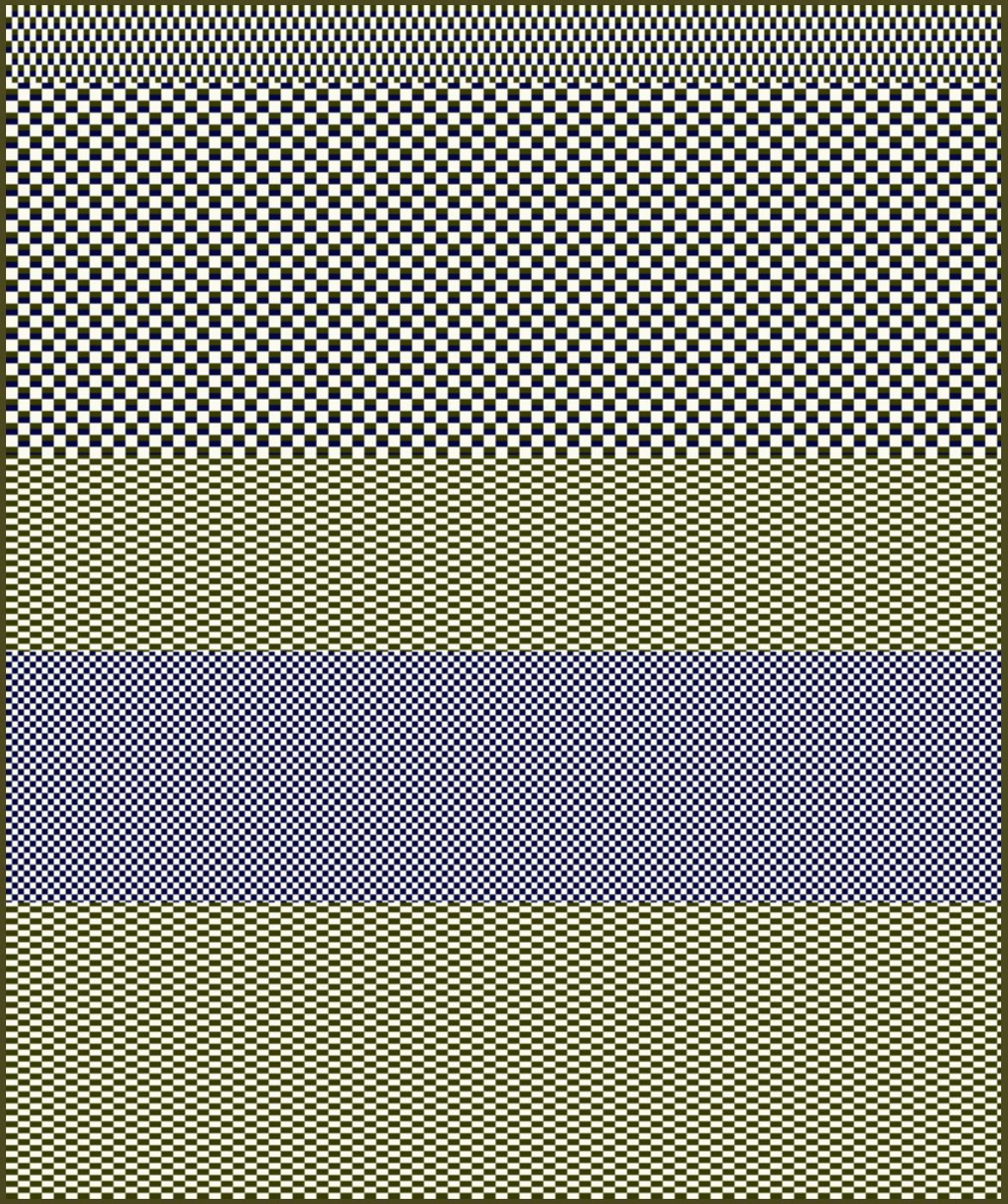
In this case, for making swatches, cutting, taping and mounting are the post processes involved.

Cutting and Taping
The woven swatch is cut out of the loom and the warp sheet. the remaining warp is taped or tied after taking through the reed. the vertical edges of the swatch are also taped to prevent fraying.

Mounting
The swatches are then window-mounted and presented.

In the case of product creation, the woven fabric is cut out of the loom. The loose ends are taken care of either by hemming or by adding a fringe by knotting loose ends together.

3 SWATCH DEVELOPMENT AND DETAILS



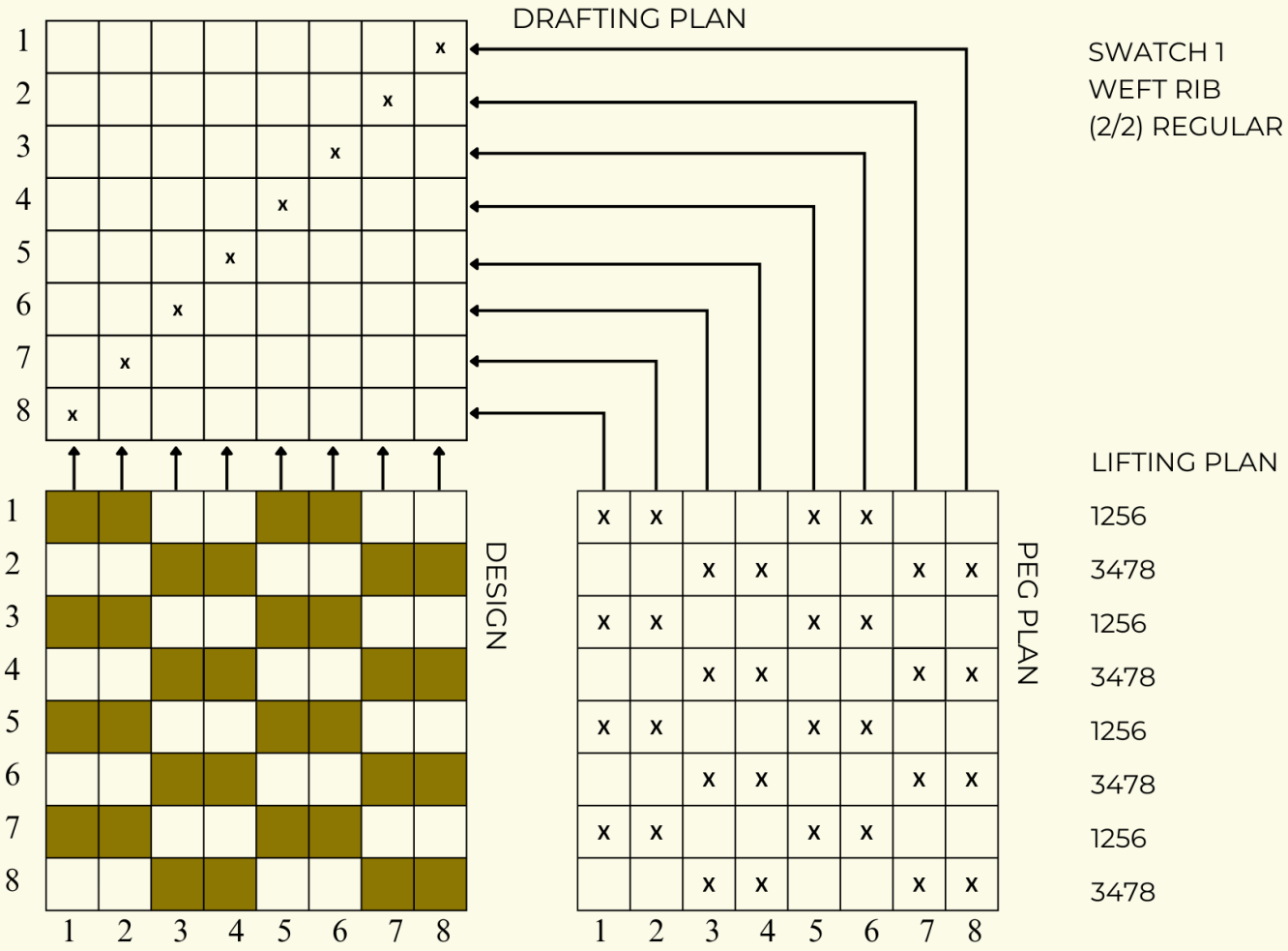
SWATCH 1: PLAIN WEAVE SAMPLE

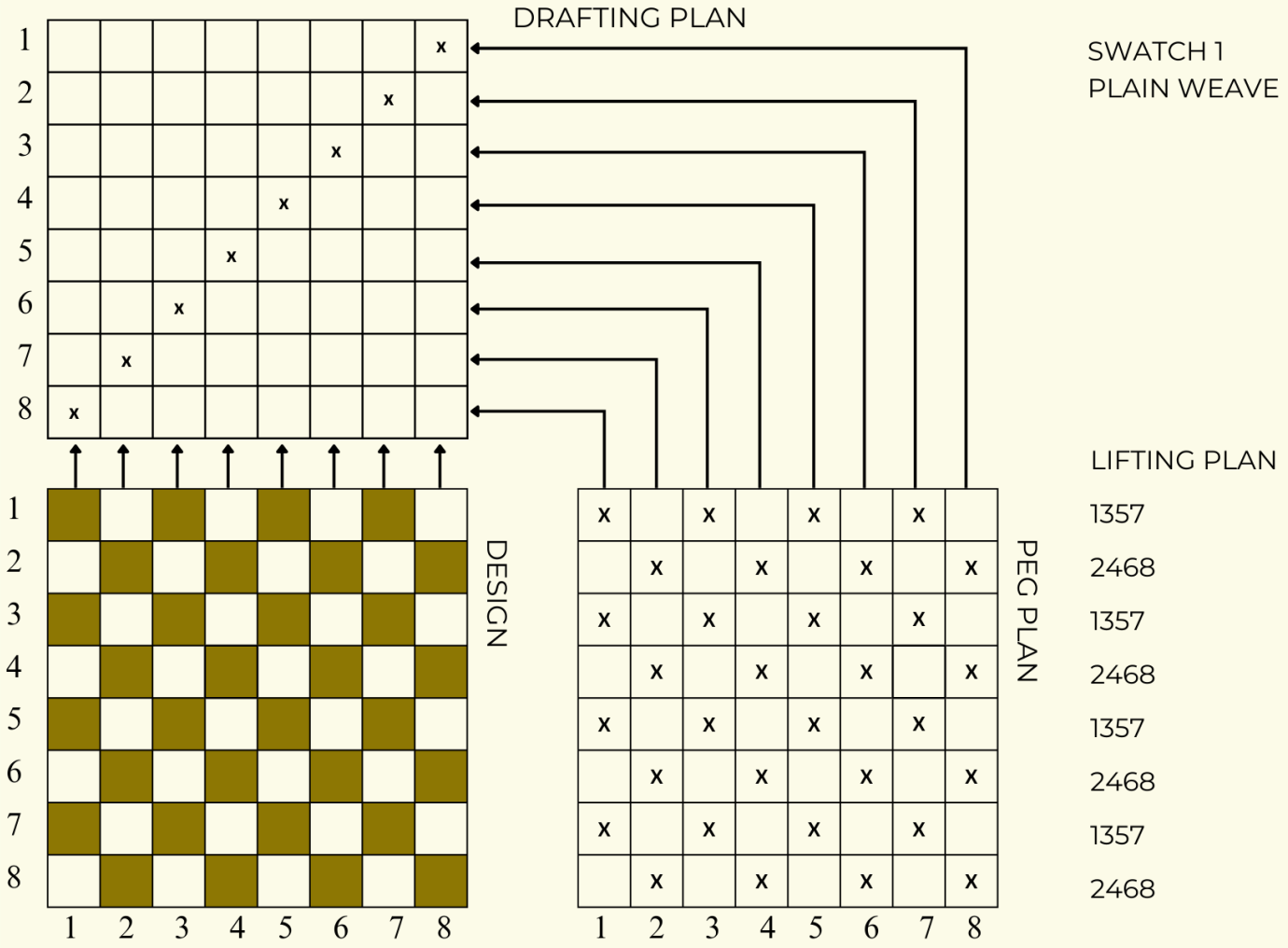
SIZE OF THE SAMPLE: 6 inches* 6 inches
MATERIAL USED:
WARP: Cotton
WEFT: cotton
SELVEDGE: Cotton

TYPE OF YARN:
WARP: 2-ply cotton yarn
WEFT: 2 ply cotton yarn
SELVEDGE: 2-ply cotton yarn

EPI:32
PPI: 26
YARN COUNT: 2/20s cotton
DRAFTING: straight draft
REED COUNT: 32
DENTING: 2 in a dent
TOTAL NUMBER OF ENDS:
SELVEDGE: (0.5)16*4=32
BODY: 5.5*16*2= 176
TOTAL NUMBER OF ENDS: 208

END USES: table runner, curtain


DRAFTING PLAN
SWATCH 1
WEFT RIB
(2/2) REGULAR
LIFTING PLAN
1256
3478
1256
3478
1256
3478
1256
3478
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 1
PLAIN WEAVE
LIFTING PLAN
1357
2468
1357
2468
1357
2468
1357
2468
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8

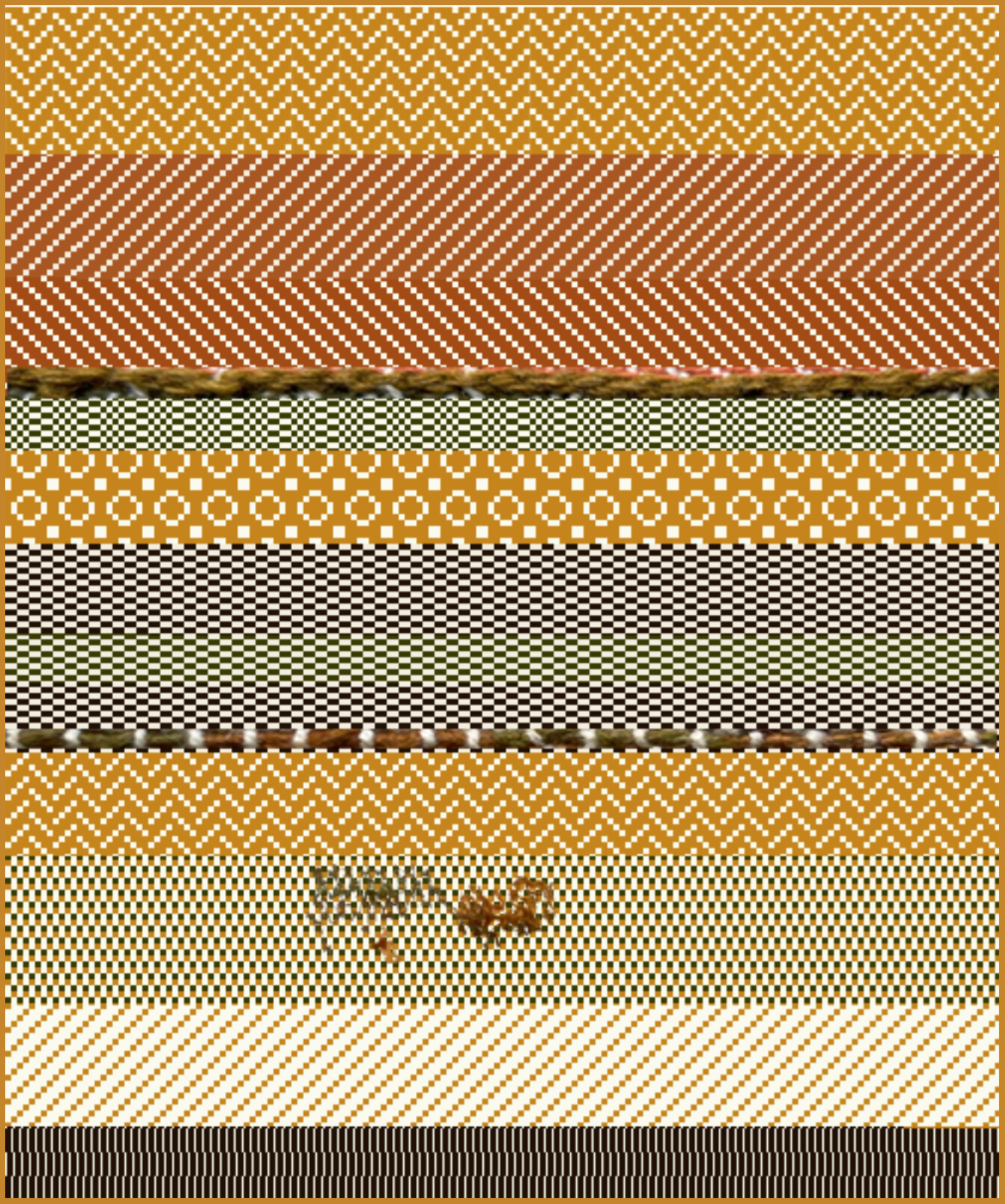
SWATCH 2: THEME BASED SAMPLE

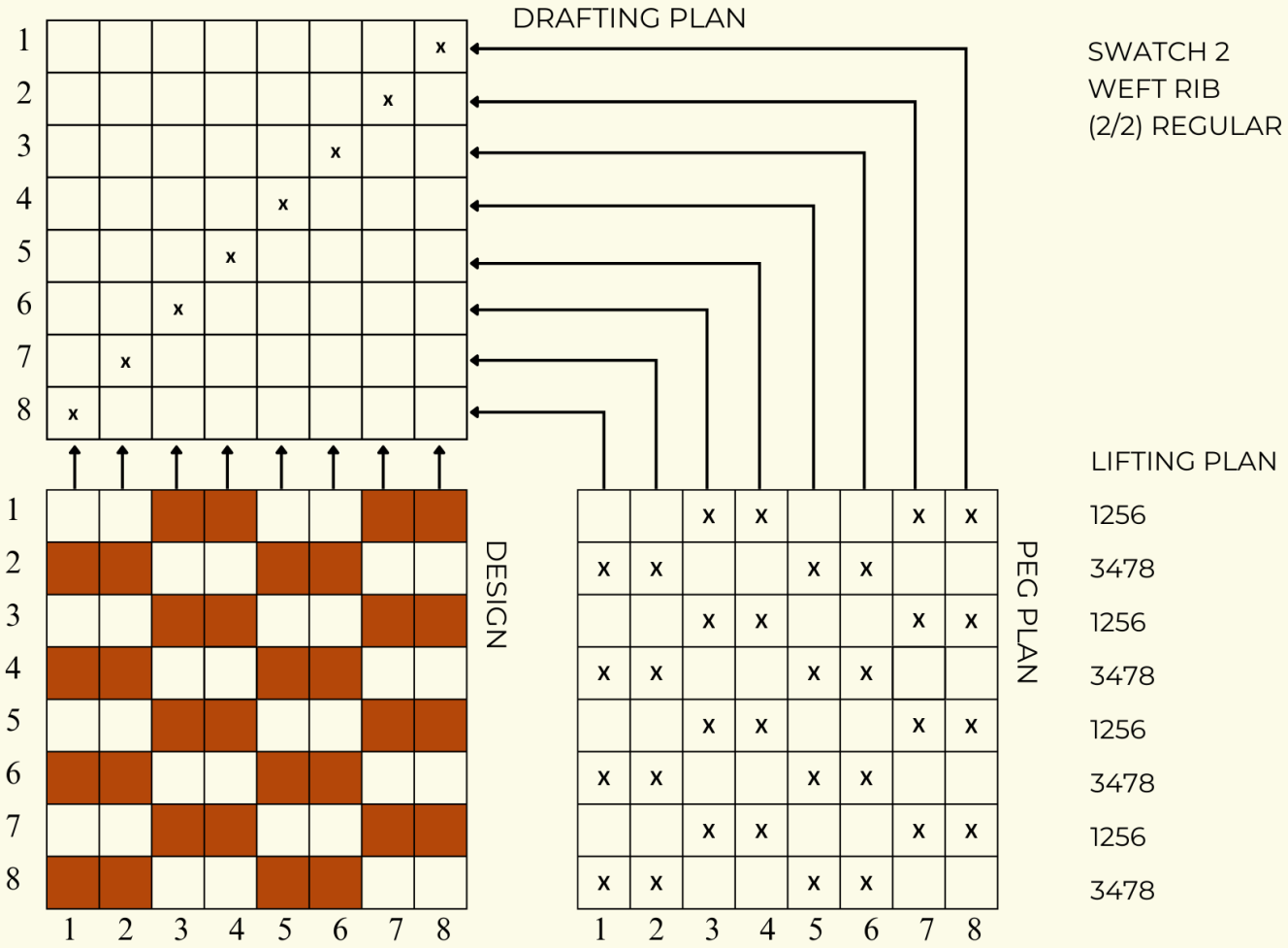
SIZE OF THE SAMPLE: 6 inches* 6 inches
MATERIAL USED:
WARP: Cotton
WEFT: cotton, waxed cotton
SELVEDGE: Cotton

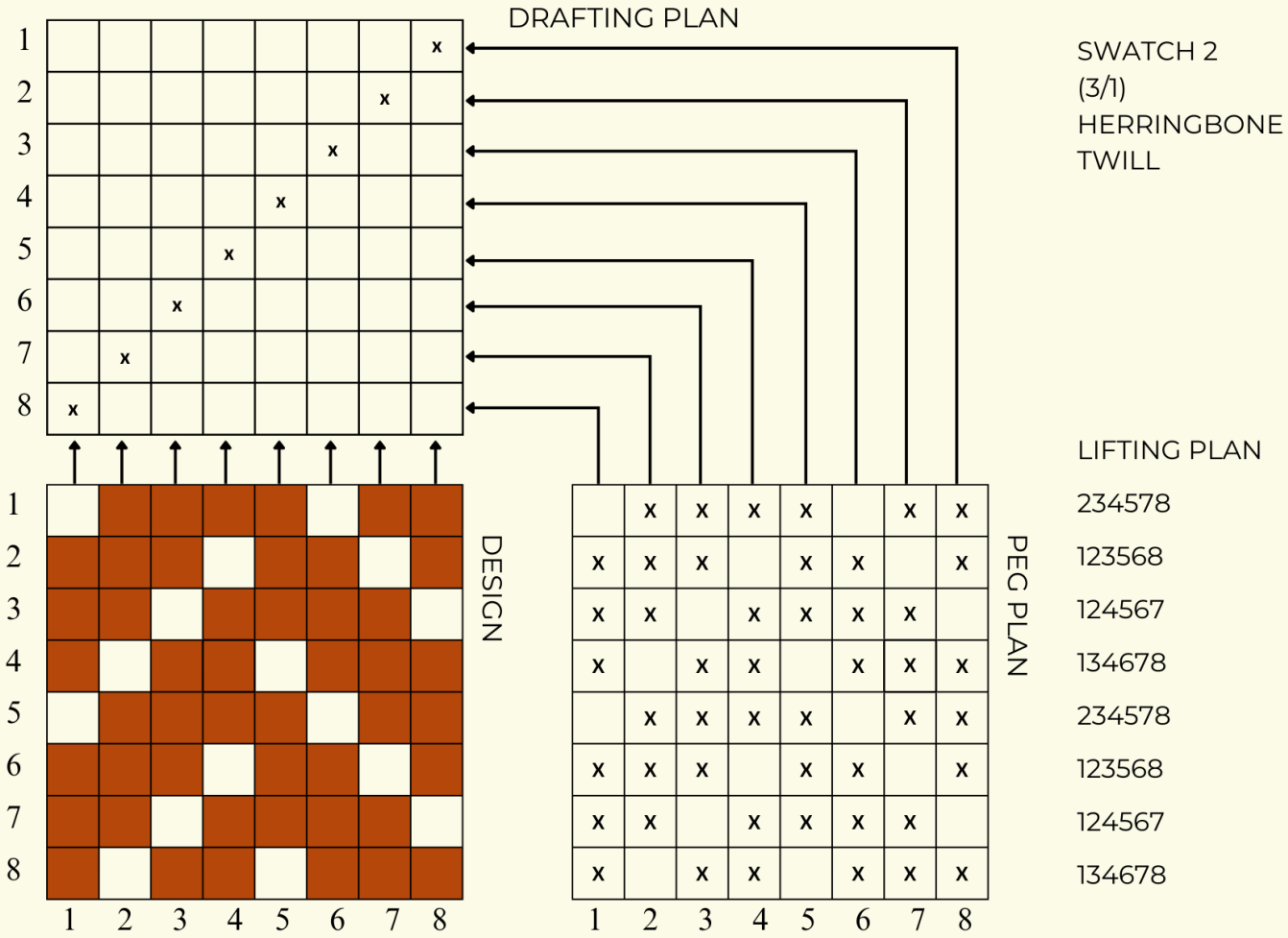
TYPE OF YARN:
WARP: 2-ply cotton yarn
WEFT: 2-ply cotton yarn, waxed cotton cord, chenille thread
SELVEDGE: 2-ply cotton yarn

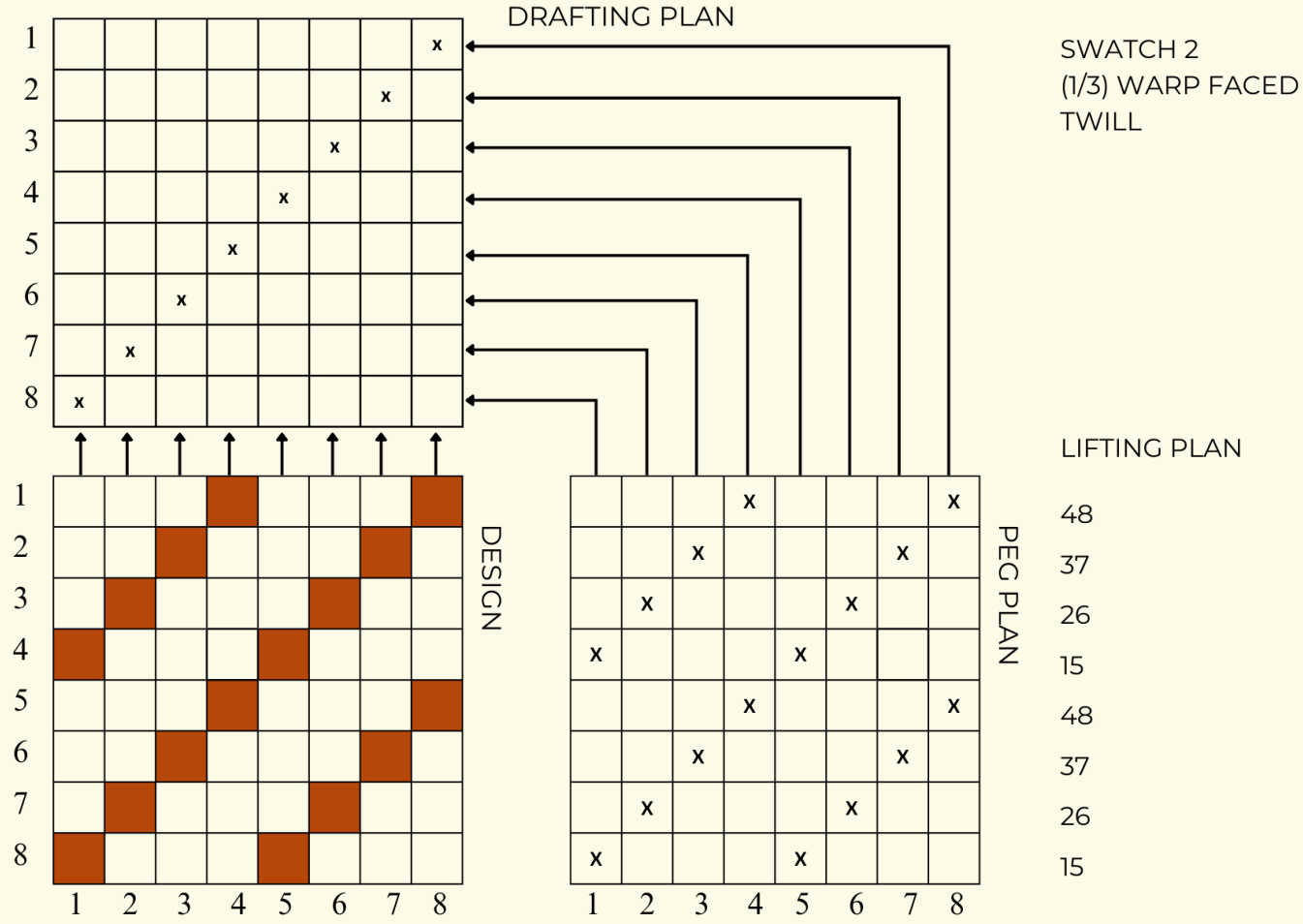
EPI:32
PPI: 24
YARN COUNT: 2/20s cotton
DRAFTING: straight draft
REED COUNT: 32
DENTING: 2 in a dent
TOTAL NUMBER OF ENDS:
SELVEDGE: (0.5)*16*4=32
BODY: 5.5*16*2= 176
TOTAL NUMBER OF ENDS: 208

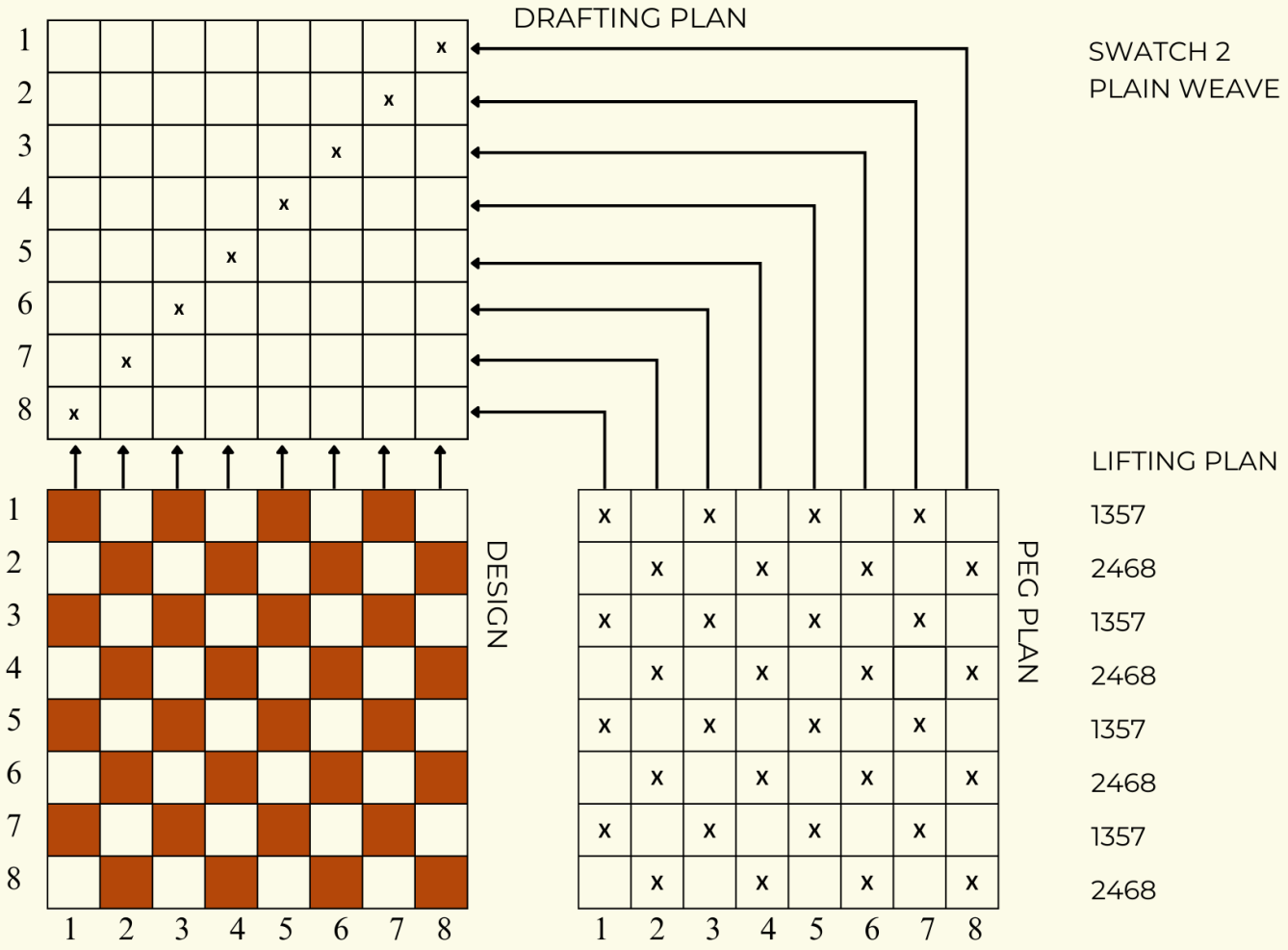
END USES:table runner, curtain

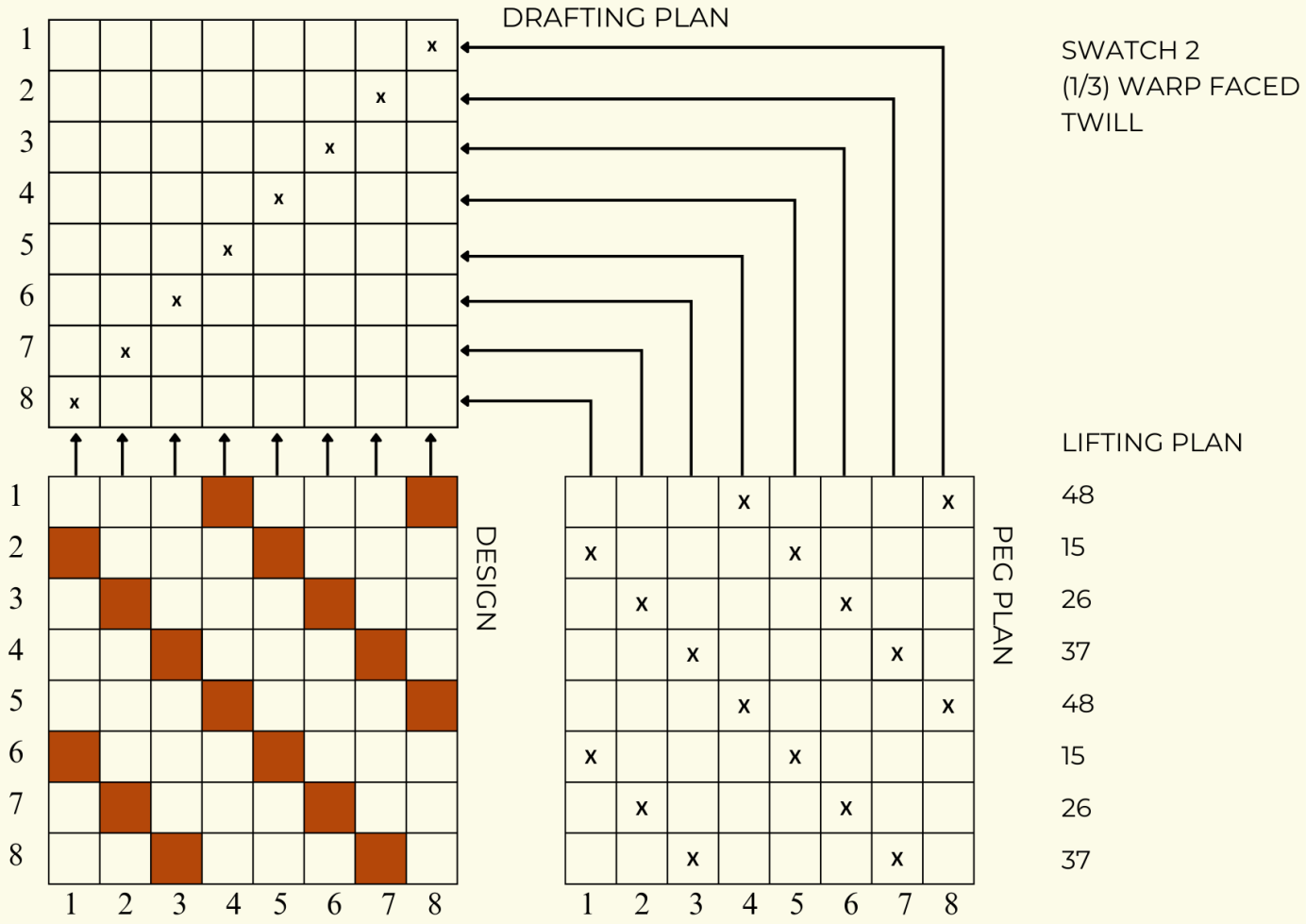


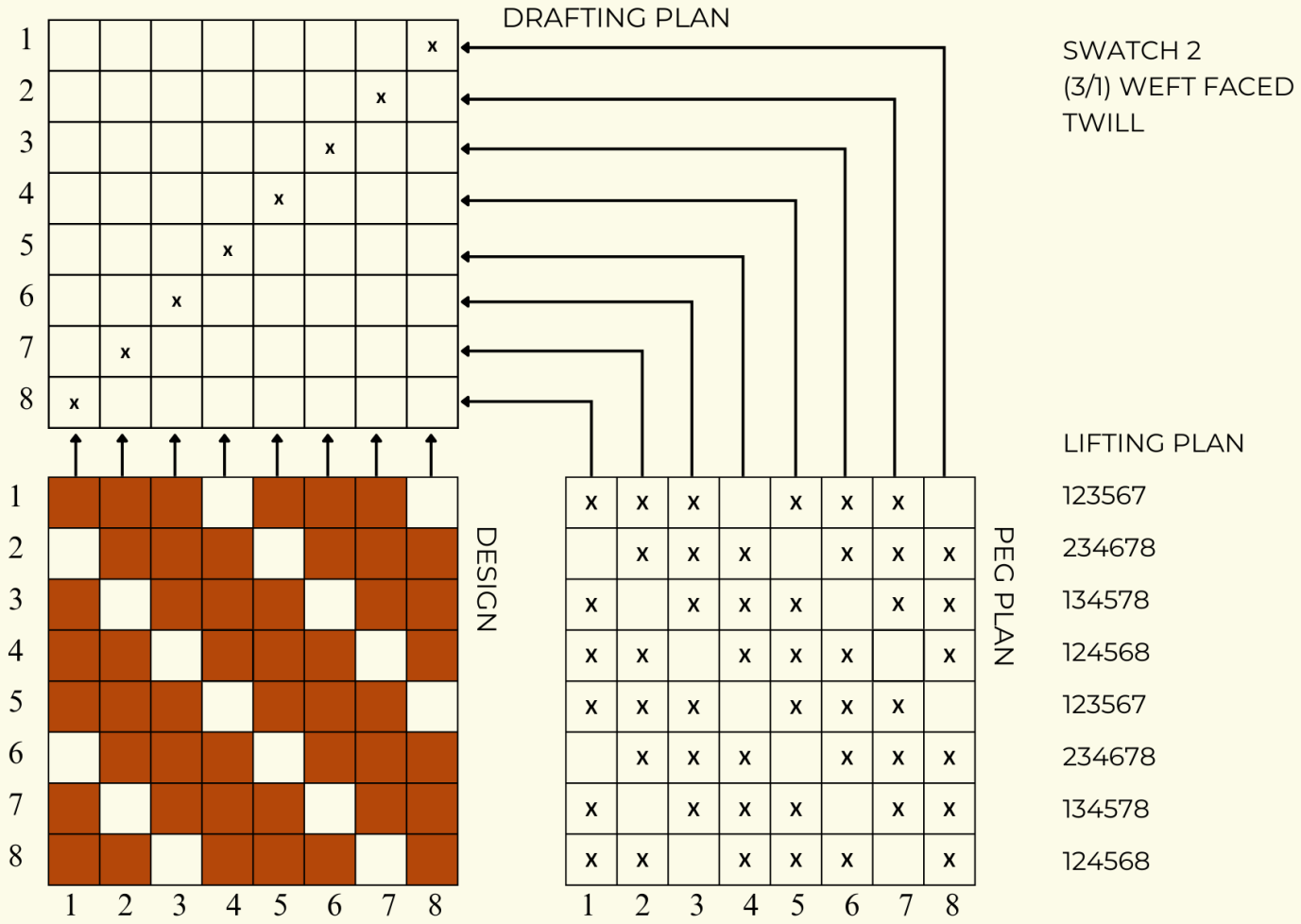

DRAFTING PLAN
SWATCH 2
WEFT RIB
(2/2) REGULAR
LIFTING PLAN
1256
3478
1256
3478
1256
3478
1256
3478
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8

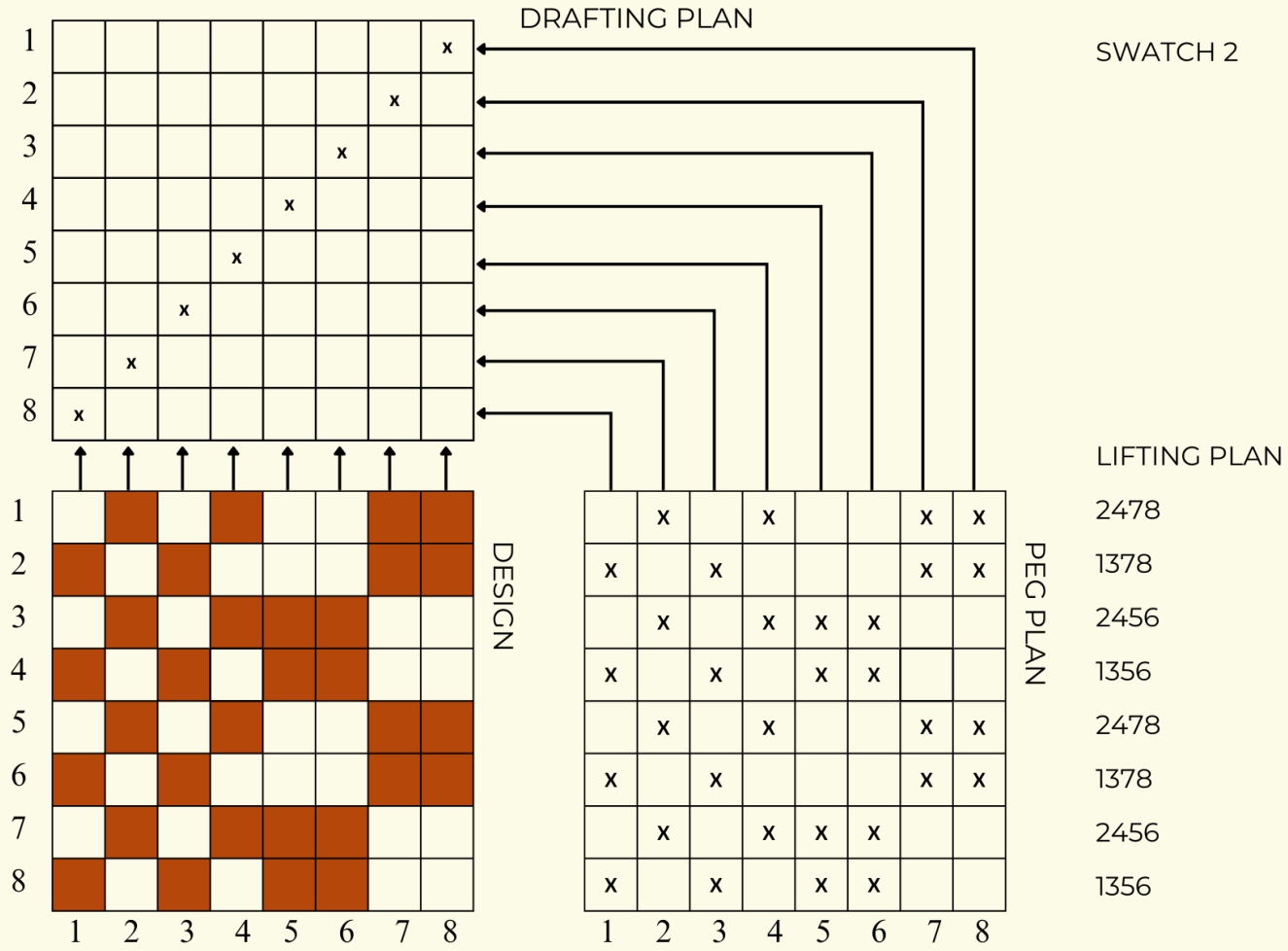

DRAFTING PLAN
SWATCH 2
(3/1)
HERRINGBONE
TWILL
LIFTING PLAN
234578
123568
124567
134678
234578
123568
124567
134678
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8

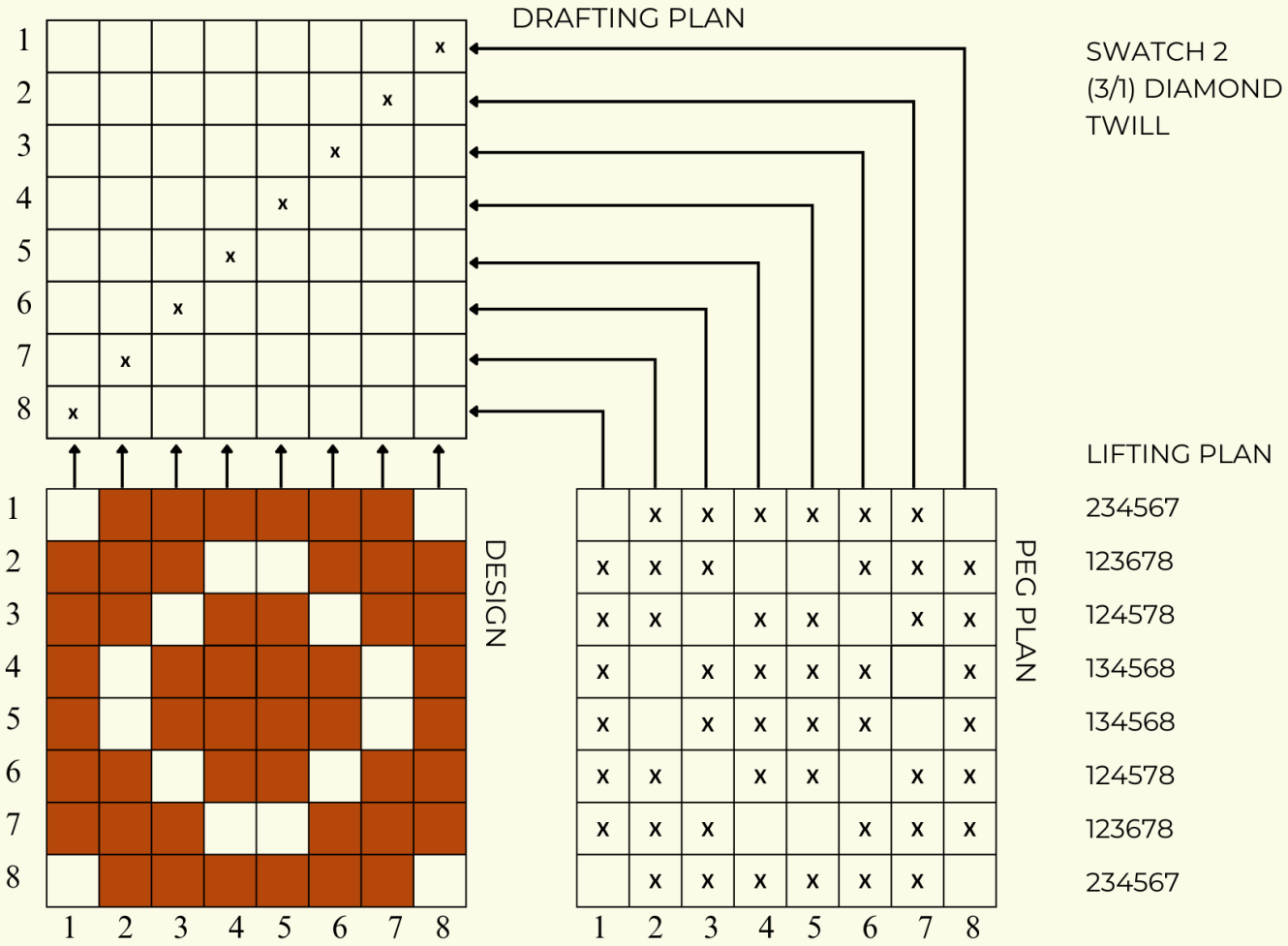

DRAFTING PLAN
SWATCH 2
(1/3) WARP FACED
TWILL
LIFTING PLAN
48
37
26
15
48
37
26
15
DESIGN
PEG PLAN

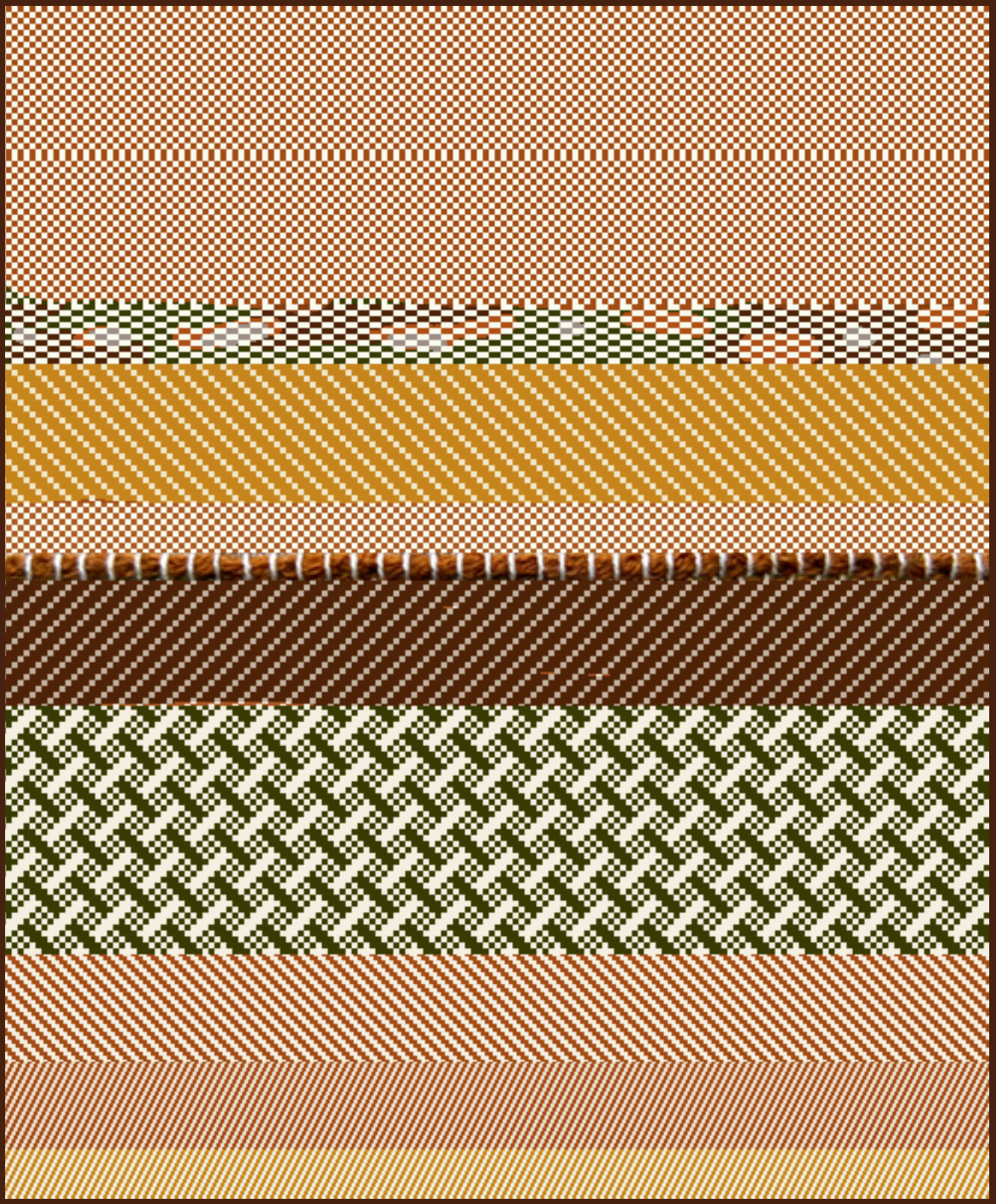

DRAFTING PLAN
SWATCH 2
PLAIN WEAVE
LIFTING PLAN
1357
2468
1357
2468
1357
2468
1357
2468
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 2
(1/3) WARP FACED
TWILL
LIFTING PLAN
48
15
26
37
48
15
26
37
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 2
(3/1) WEFT FACED
TWILL
LIFTING PLAN
123567
234678
134578
124568
123567
234678
134578
124568
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 2
LIFTING PLAN
DESIGN
PEG PLAN
2478
1378
2456
1356
2478
1378
2456
1356


DRAFTING PLAN
SWATCH 2
(3/1) DIAMOND
TWILL
LIFTING PLAN
234567
123678
124578
134568
134568
124578
123678
234567
DESIGN
PEG PLAN



SWATCH 3: THEME BASED SAMPLE

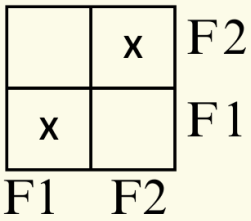
SIZE OF THE SAMPLE: 6 inches* 6 inches
MATERIAL USED:
WARP: Cotton
WEFT: cotton,
SELVEDGE: Cotton

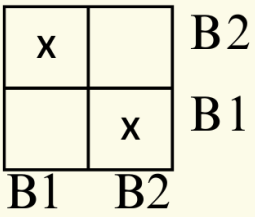
TYPE OF YARN:
WARP: 2-ply cotton yarn
WEFT: 2- ply cotton thread
SELVEDGE: 2-ply cotton yarn

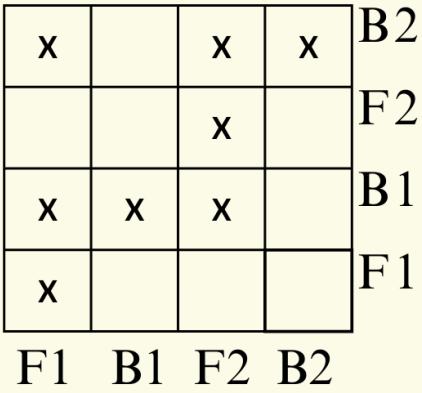
EPI:32
PPI: 20
YARN COUNT: 2/20s cotton
DRAFTING: straight draft
REED COUNT: 32
DENTING: 2 in a dent
TOTAL NUMBER OF ENDS:
SELVEDGE: (0.5)*16*4=32
BODY: 5.5*16*2= 176
TOTAL NUMBER OF ENDS: 208

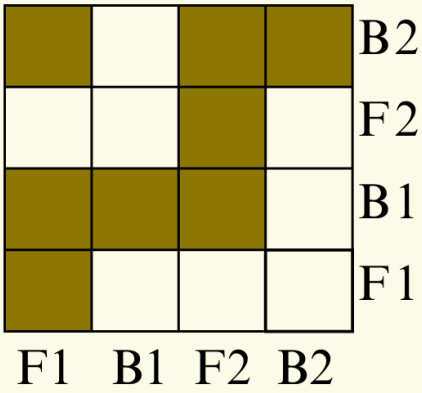
END USES: table runner

DOUBLE CLOTH









SWATCH 3
DOUBLE CLOTH
PLAIN WEAVE
WITH
INTERCHANGE

Ratio 1:1
Warp ratio 1:1
Weft ratio 1:1
F1B1F2B2

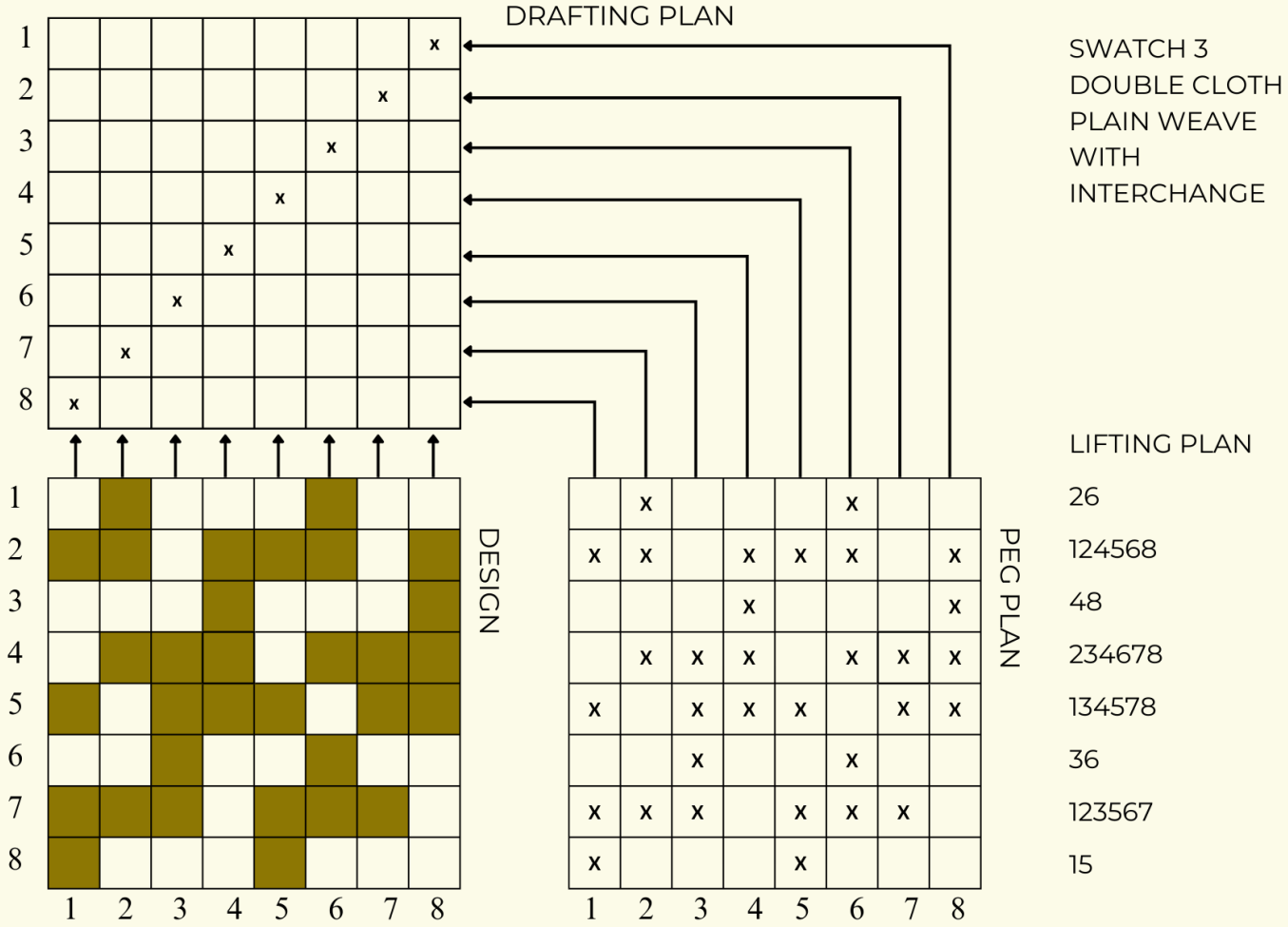
LIFTING PLAN

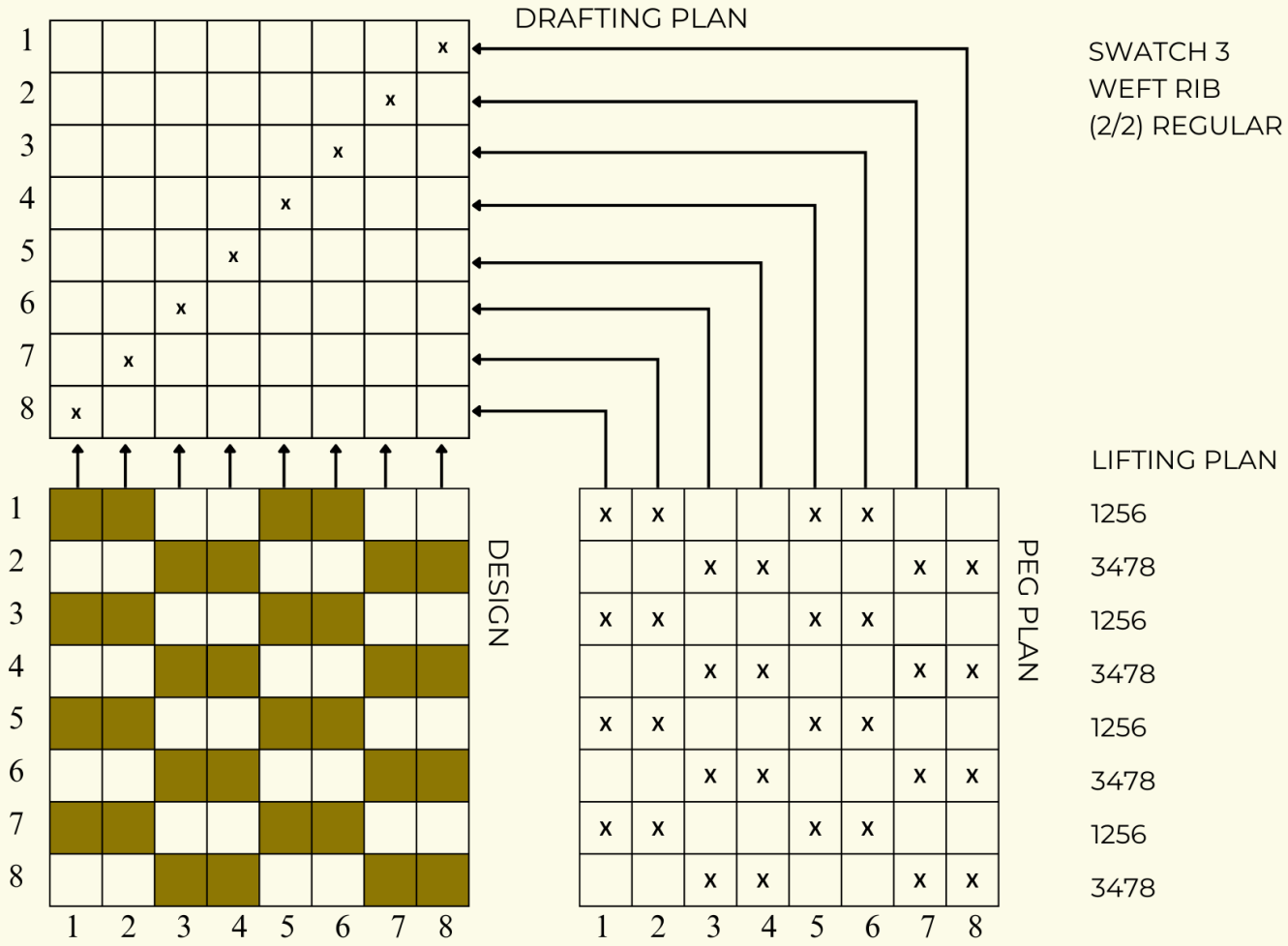
134

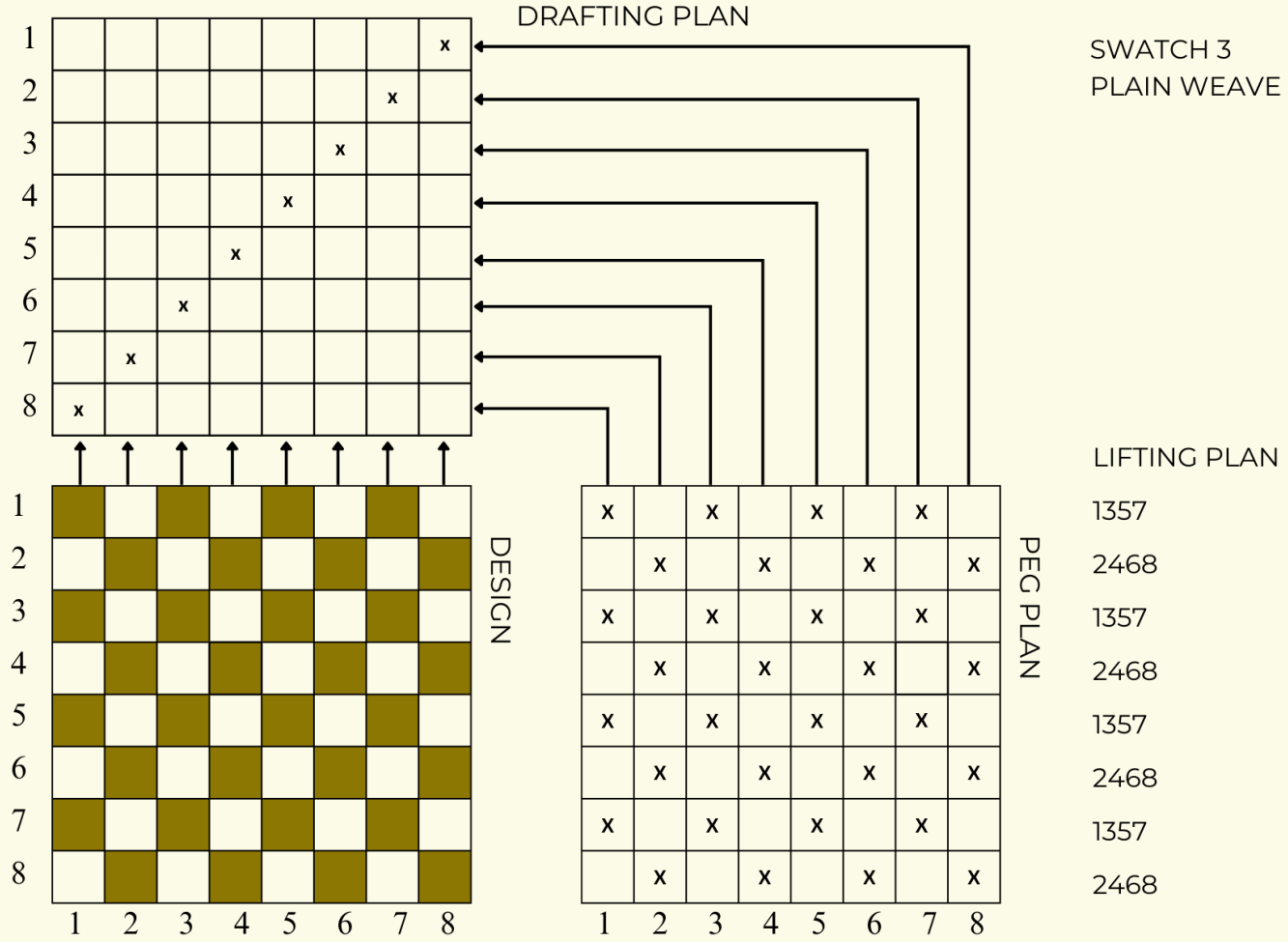
3

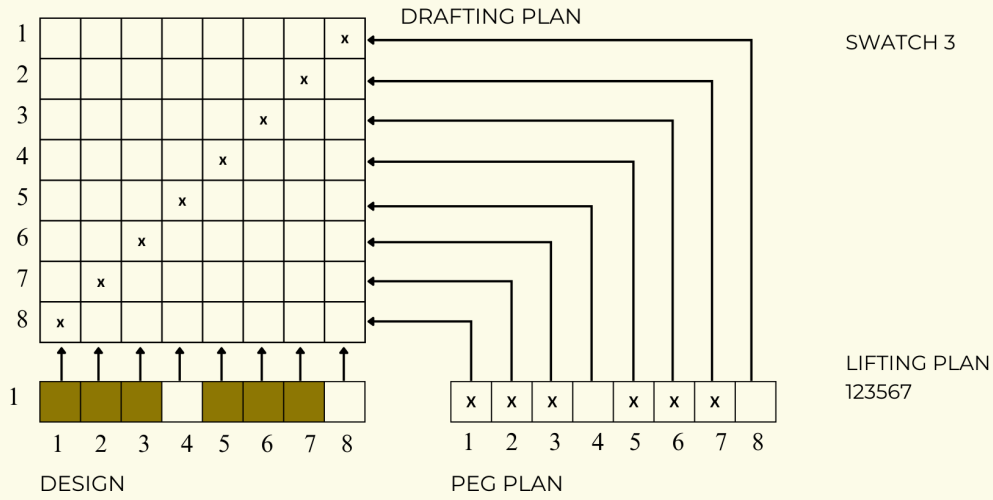
123

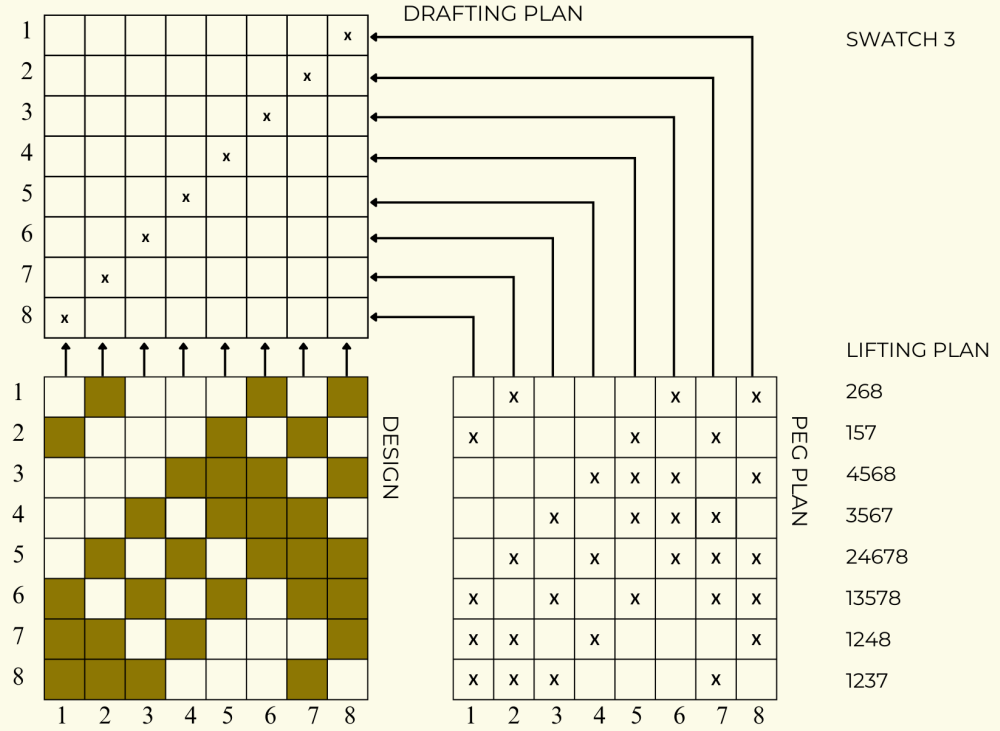
1

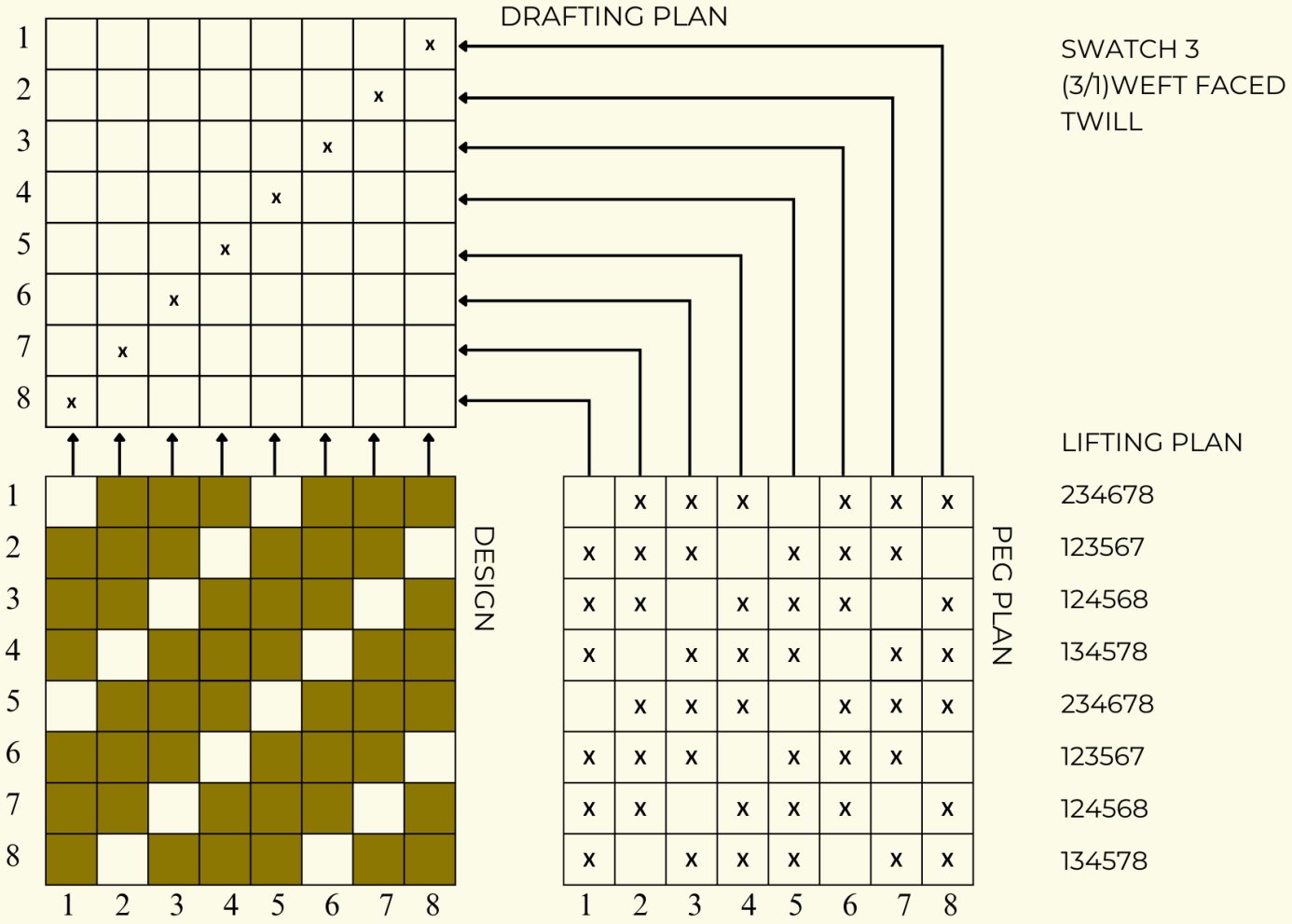

DRAFTING PLAN
SWATCH 3
DOUBLE CLOTH
PLAIN WEAVE
WITH
INTERCHANGE
LIFTING PLAN
26
124568
48
234678
134578
36
123567
15
DESIGN
PEG PLAN


DRAFTING PLAN
SWATCH 3
WEFT RIB
(2/2) REGULAR
LIFTING PLAN
1256
3478
1256
3478
1256
3478
1256
3478
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 3
PLAIN WEAVE
LIFTING PLAN
1357
2468
1357
2468
1357
2468
1357
2468
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 3
LIFTING PLAN
123567
DESIGN
PEG PLAN


DRAFTING PLAN
SWATCH 3
LIFTING PLAN
268
157
4568
3567
24678
13578
1248
1237
DESIGN
PEG PLAN


DRAFTING PLAN
SWATCH 3
(3/1)WEFT FACED
TWILL
LIFTING PLAN
234678
123567
124568
134578
234678
123567
124568
134578
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8

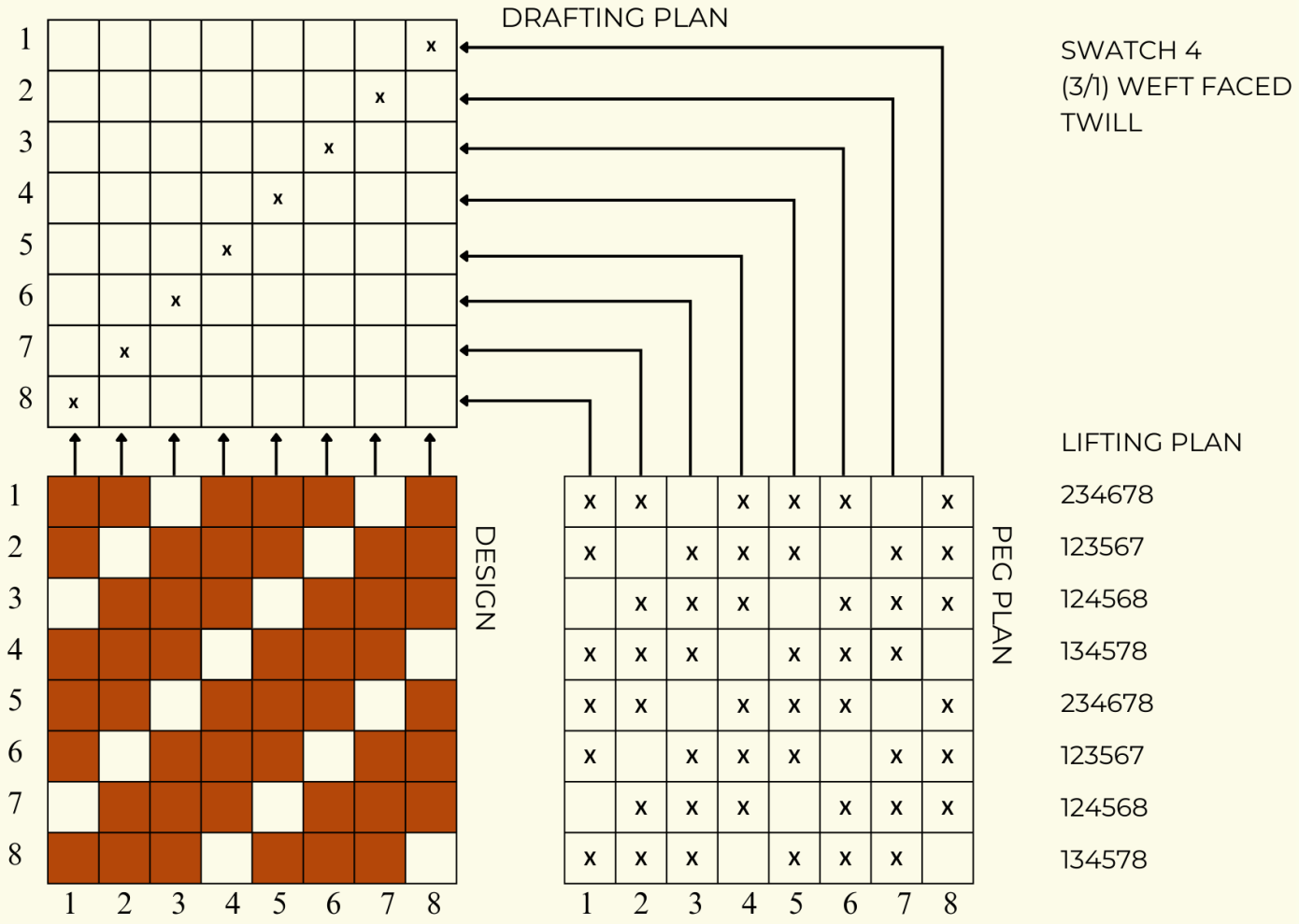
SWATCH 4: THEME BASED SAMPLE

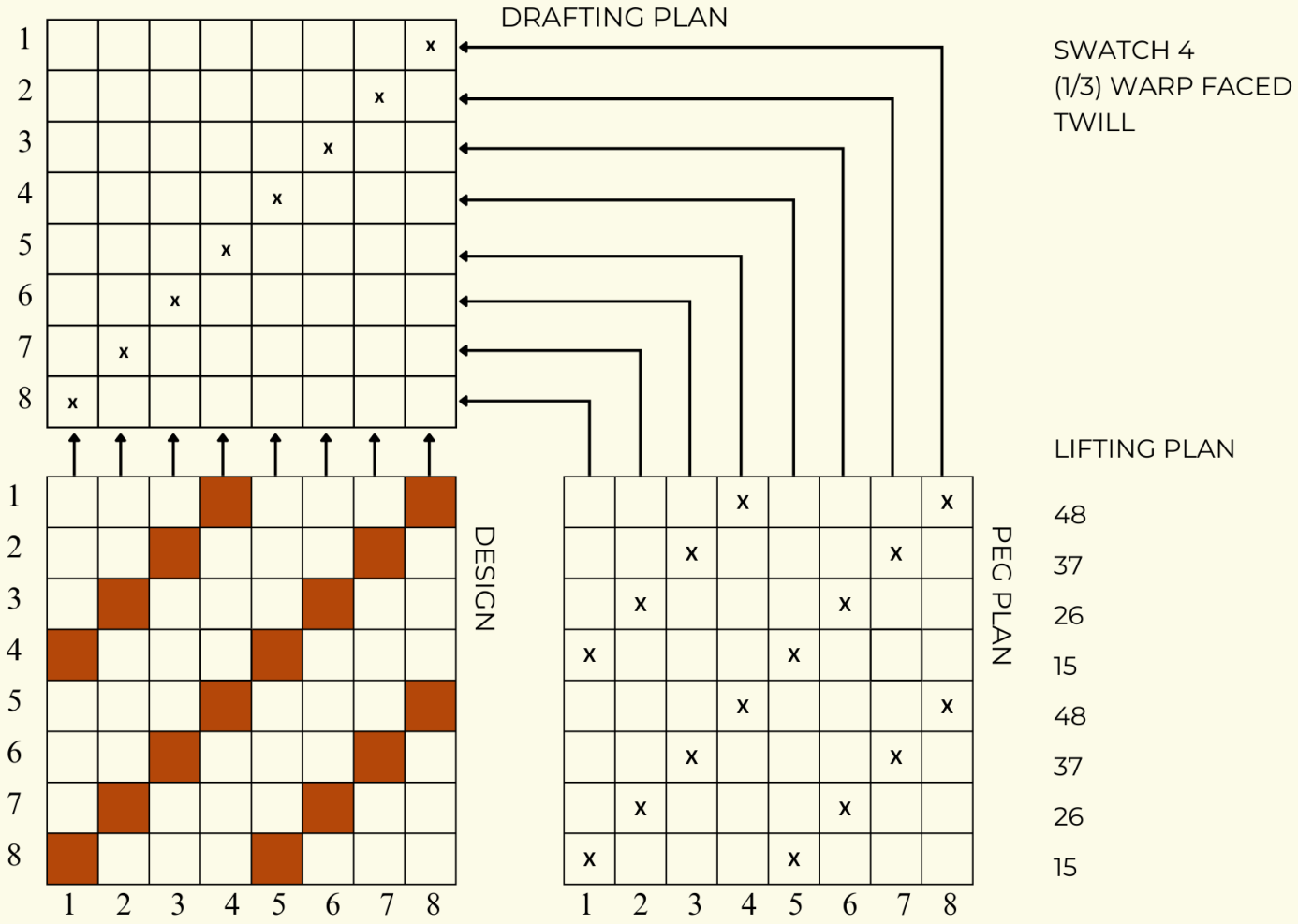
SIZE OF THE SAMPLE: 6 inches* 6 inches
MATERIAL USED:
WARP: Cotton
WEFT: cotton
SELVEDGE: Cotton

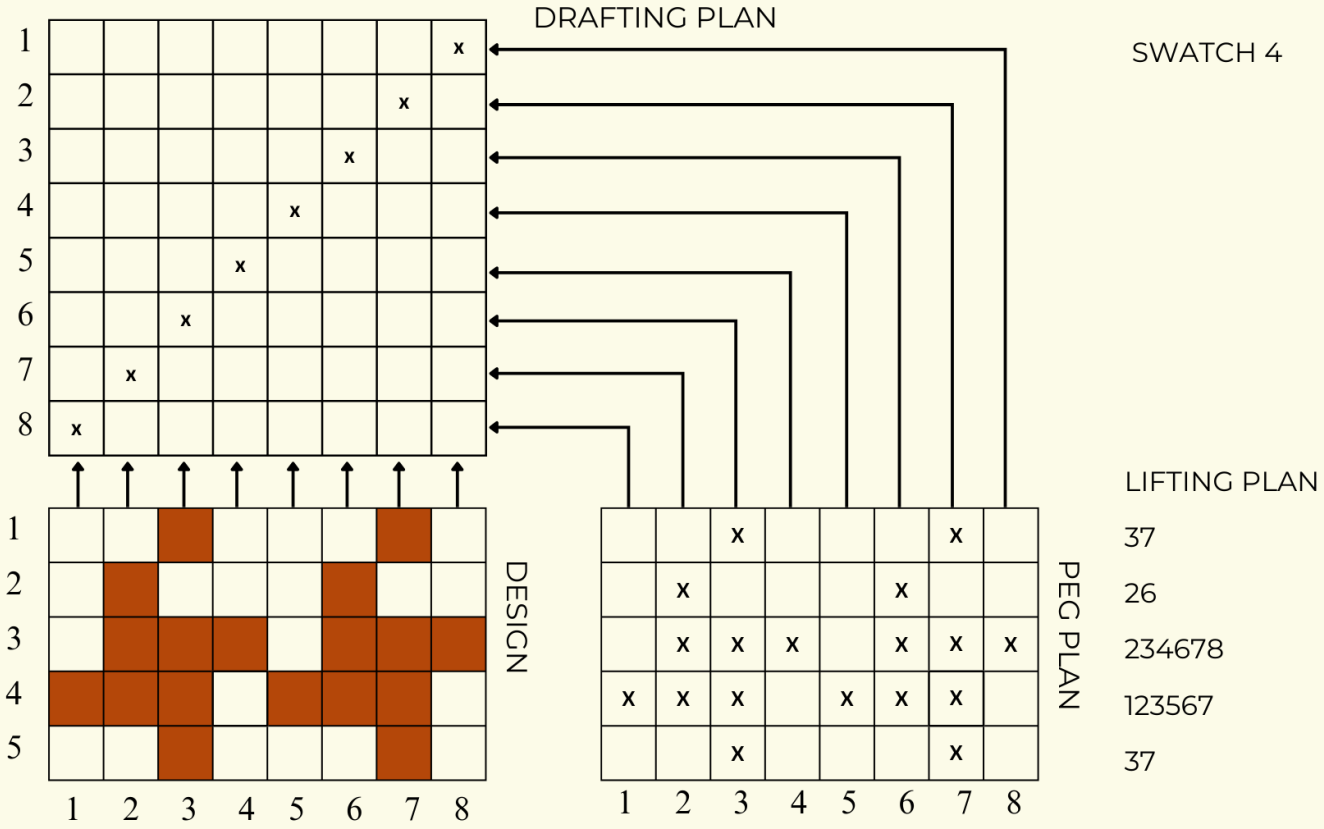
TYPE OF YARN:
WARP: 2-ply cotton yarn
WEFT: 2-ply cotton yarn
SELVEDGE: 2-ply cotton yarn

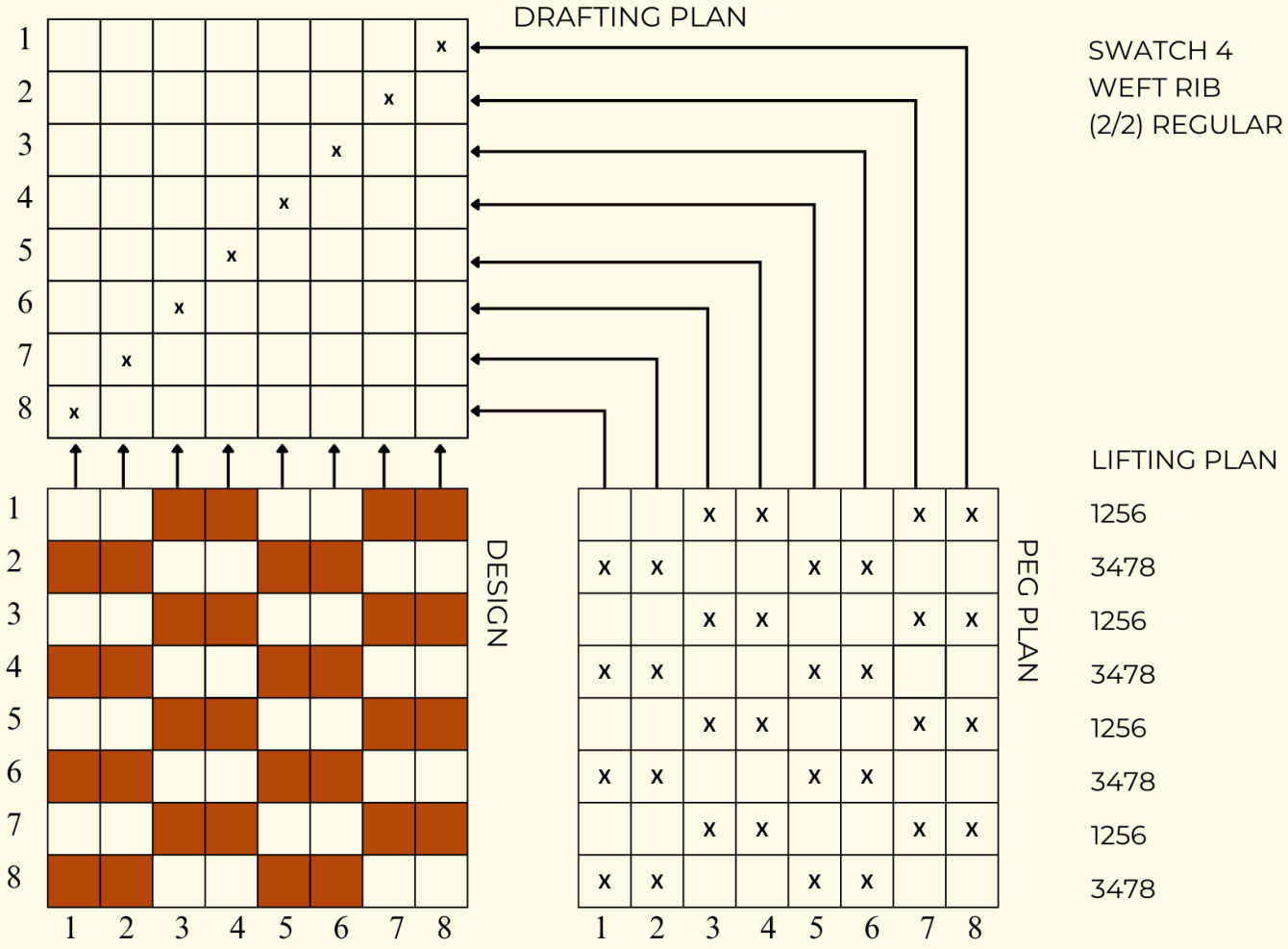
EPI:32
PPI: 25
YARN COUNT: 2/20s cotton
DRAFTING: straight draft
REED COUNT: 32
DENTING: 2 in a dent
TOTAL NUMBER OF ENDS:
SELVEDGE: (0.5)*16*4=32
BODY: 5.5*16*2= 176
TOTAL NUMBER OF ENDS: 208

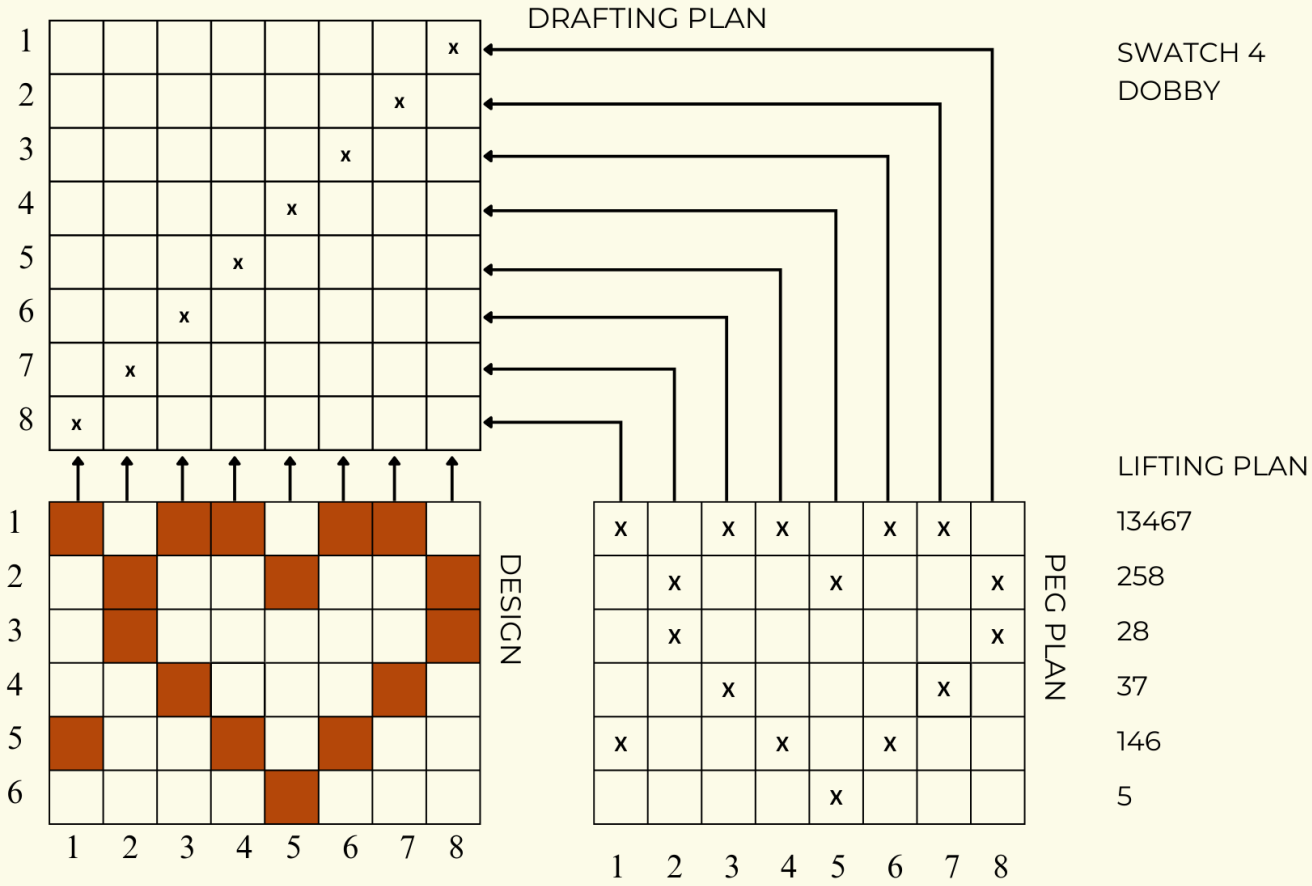
END USES: table runner

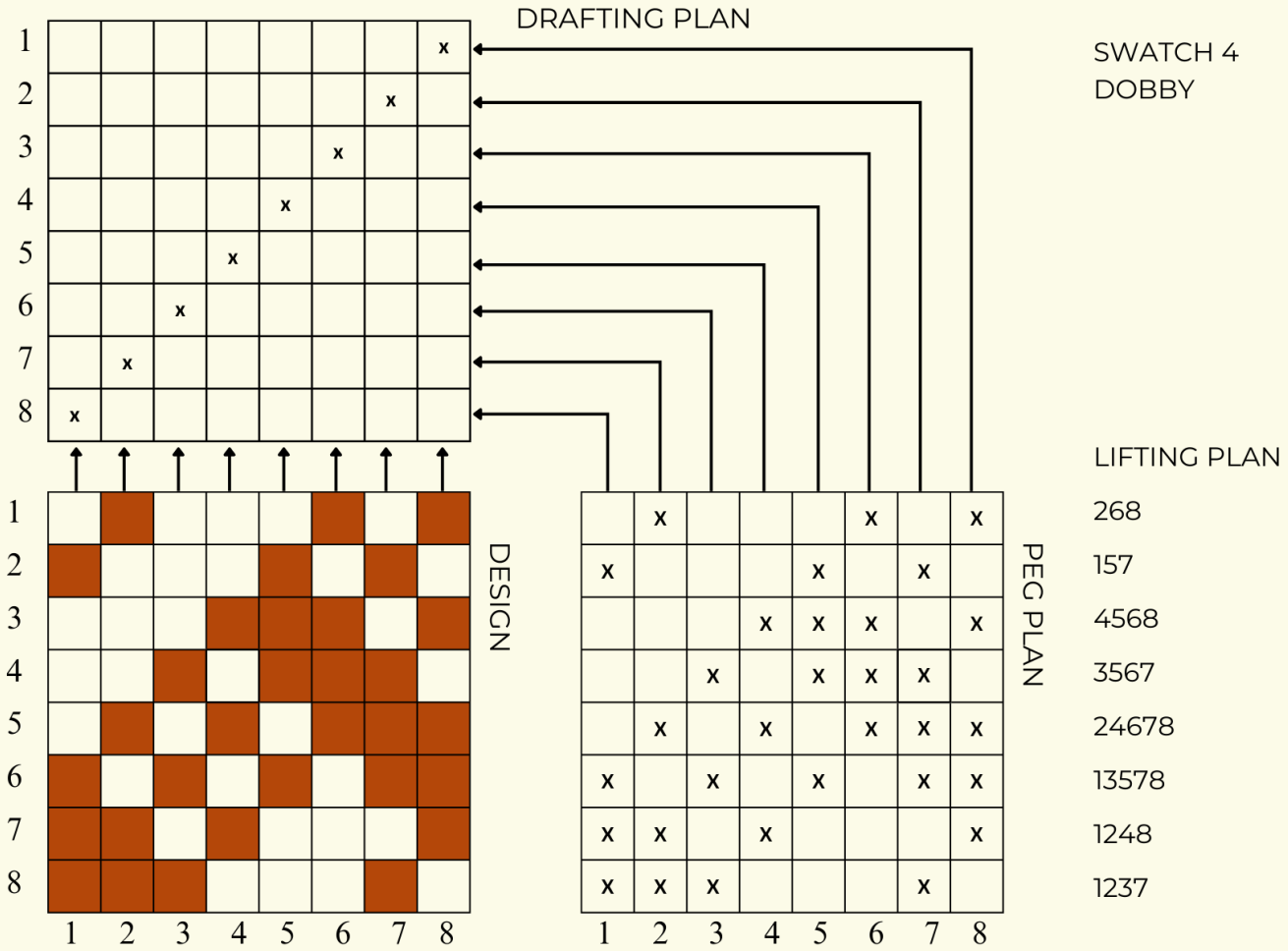

DRAFTING PLAN
SWATCH 4
(3/1) WEFT FACED
TWILL
LIFTING PLAN
234678
123567
124568
134578
234678
123567
124568
134578
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8

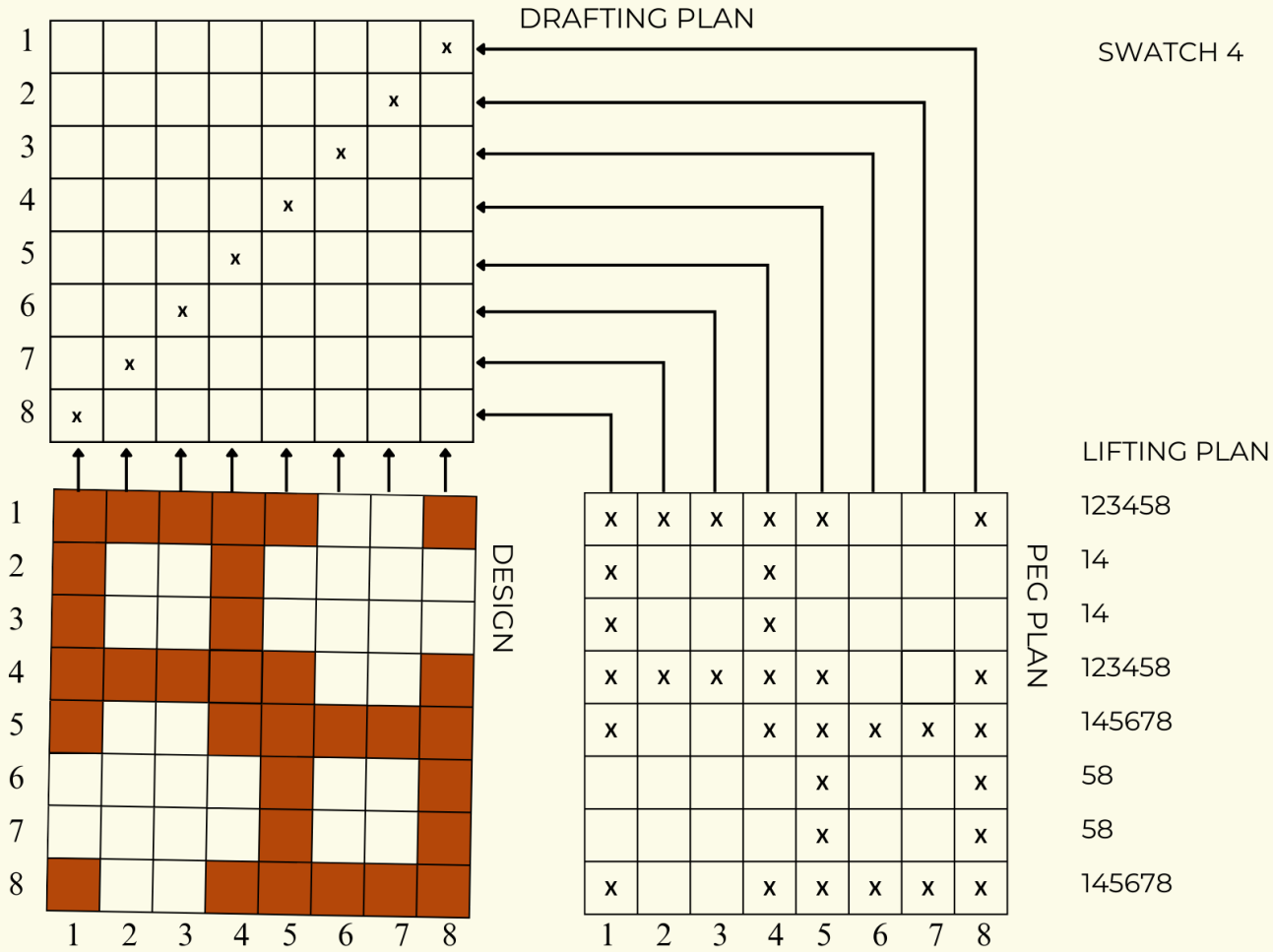

DRAFTING PLAN
SWATCH 4
(1/3) WARP FACED
TWILL
LIFTING PLAN
DESIGN
PEG PLAN
48
37
26
15
48
37
26
15


DRAFTING PLAN
SWATCH 4
LIFTING PLAN
37
26
234678
123567
37
DESIGN
PEG PLAN


DRAFTING PLAN
SWATCH 4
WEFT RIB
(2/2) REGULAR
LIFTING PLAN
1256
3478
1256
3478
1256
3478
1256
3478
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 4
DOBBY
LIFTING PLAN
13467
258
28
37
146
5
DESIGN
PEG PLAN
1 2 3 4 5 6 7 8


DRAFTING PLAN
SWATCH 4
DOBBY
LIFTING PLAN
DESIGN
PEG PLAN
268
157
4568
3567
24678
13578
1248
1237


DRAFTING PLAN
SWATCH 4
LIFTING PLAN
123458
14
14
123458
145678
58
58
145678
DESIGN
PEG PLAN

4 INSIGHTS AND ANNEXURE

Learning Outcome

I am extremely grateful to have had the opportunity to explore weaving in this class. It helped me not only understand the tools, terminologies and techniques required for the creation of fabric but also gave me a newfound appreciation for handlooms. It also helped me understand why certain fabrics behave in certain ways which will be extremely helpful during sourcing.

Glossary

Cambric: A delicate, lightweight fabric that is somewhat glossy and stiff. It is named after its place of origin, Cambric in France.

Muslin: Muslin is a plain woven cotton fabric that can be made in a wide range of weights depending on the purpose. It gets its name from the city of Mosul in Iraq where it was first manufactured.

Drill cloth: A stout, durable cotton fabric with a strong bias in the weave.

Shuttle: A shuttle is a tool designed to neatly and compactly store a holder that carries the thread of the weft yarn while weaving with a loom.

Projectile: An object thrown into the air and subjected to the acceleration of gravity.

Rapier: finger-like hooks that carry the weft yarn through the warp shed.

Hank: A coil of fibre or fibre-like materials.

Bibliography

Kiron, M. I. (2021, October 13). Different types of fabric weave structure. Textile Learner. https://textilelearner.net/types-of-fabric-weave-structure/

Satin weave. (2014, May 3). [Slide show]. PPT. https://www.slideshare.net/sheshir/satin-weave

Name, Y. (n.d.). Derivatives of Twill Weave ~ A Textile Blog run by NITERians. https://niterians.blogspot.com/2016/07/derivatives-of-twill-weave_12.html#:~:text=Derivatives%20of%20Twill%20Weave%3A%201.%20Zig-Zag%20Twill%20%28read,Stepped%20or%20Elongated%20Twill%209.%20Rearranged%20Twill%20

Treasurie. (2023, November 20). Plain Weave - Structure, properties, uses & types. Treasurie. https://blog.treasurie.com/plain-weave/

Treasurie. (2023a, September 19). Twill Weave - Structure, properties, uses & types. Treasurie. https://blog.treasurie.com/twill-weave/

Babu, S. (2020, May 27). RIB WEAVE, WARP RIB, WEFT RIB, REGULAR RIB AND IRREGULAR RIB WEAVES. https://www.textileadvisor.com/2020/05/rib-weave-warp-rib-weft-rib-regular-rib.html

What are the primary and secondary motions? Auxiliary Functions of weaving process. (n.d.). https://textileapex.blogspot.com/2014/08/primary-secondary-motions-auxiliary-functions-weaving.html#:~:text=Primary%20Motions&text=Picking%3A%20Passing%20the%20weft%20thread,point%20known%20as%20the%20fell.